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A DELL TRADE PAPERBACK

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TO MY FAMILY AND FRIENDS

TIM HARTNELL—SERIES EDITOR

Tim Hartnell is a leading computer expert and journalist, who has contributed extensively to the Technical Consumer Press. He is also the author of several books including *Getting Acquainted With Your ZX81, Let Your BBC Micro Teach You to Program* and *Programming Your ZX Spectrum*.

PAUL BUNN—THE AUTHOR

Paul Bunn is a 16-year-old schoolboy studying for his "O" levels, and has owned an Atari for one and a half years. He has also written *Total Control,* a programming manual for the Atari, published by *Interface*.

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Sue Walliker is a freelance illustrator.

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CONTENTS

Editor's Introduction

Your computer is waiting to challenge you. Moving graphics games, brain stretchers, word games and puzzles are all here and ready to entertain you.

A wide variety of games are included in this book. The programs have been written by some of the most talented young programmers working in this country at the moment, and represent a variety of approaches to solving programming problems.

An examination of the listings should teach you many tricks and techniques to apply to your own programming. And once you have mastered the programs in their present form, you might want to try your hand at improving them. There is no such thing as a "perfect program," so these games are sure to benefit from your programming skill.

All that now remains is for you to turn the page and enter the programs. I can only hope that you enjoy playing the games as much as we did when preparing this volume.

TIM HARTNELL, series editor

London
March 1983

Author's Introduction

I have tried in this book to give as many programs as possible which fully use the capabilities of the Atari 400/800 home computers. Many of the programs use redefined character sets, some use a fine capability of the Atari computers called player-missile graphics.

I hope you enjoy playing the games, though you will benefit much more if you look at the listings and try to see how they work. Moreover, you can take ideas from these programs and use them in your own programs.

PAUL BUNN

Keynsham, Avon
January 1983

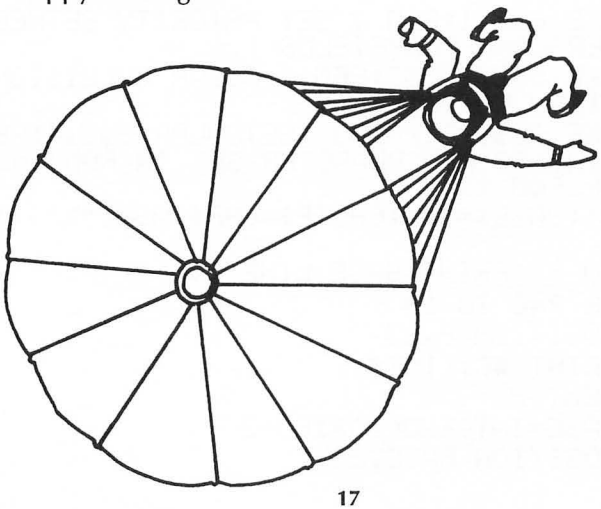
SKYDIVER

(Uses the Joystick)

This program uses redefined characters and player-missile graphics. The object of the game—which should not be played by anyone scared of heights!—is to get the highest score possible in 10 jumps.

Your plane flies across the top of the screen: to jump out you press the red trigger button, and you will then descend at a rapid speed. When you wish to slow up, pull the joystick down and your 'chute will open. You receive bonus points if you manage to land safely on the landing pad. This bonus depends on when you open your parachute—the later you open it the better your score will be. Below a certain point, however, you cannot open the 'chute. A score of around 12,000 is reasonable.

Happy landing!



```
10 REM %%  SKY DIVER - WRITTEN BY  %%
20 REM %% PAUL BUNN  DECEMBER 1982 %%
25 IF PEEK(203)=PEEK(106)-8 THEN 40
30 GOSUB 10000:REM INITIALIZATION
40 DIM PLANE$(1),MAN$(1),CHUTE$(1),BASE$
(1),LINE$(1)
50 PLANE$=CHR$(ASC("%")+128):MAN$="!":LI
NE$=CHR$(ASC("#")+96)
55 FOR JUMP=1 TO 10
60 GRAPHICS 17:SETCOLOR 2,12,10:POKE 16,
64:POKE 53774,64
61 POKE 53277,3:REM % ENABLE PLAYER MISS
ILE GRAPHICS %
62 POKE 559,46:REM % DOUBLE LINE RESOLUT
ION FOR PLAYERS %
63 POKE 54279,PEEK(204):REM % TELL ANTIC
 WHERE PM GRAPHICS ARE IN RAM %
64 POKE 53256,3:POKE 53257,3:REM % QUADR
OUPLE SIZE FOR CLOUDS %
65 POKE 704,8:POKE 705,14:REM % COLOUR F
OR CLOUDS %
66 X3=INT(RND(0)%100)+75:POKE 53248,X3:R
EM %% RANDOM HORIZONTAL POSITION FOR CLO
UD 1 %%
67 X4=INT(RND(0)%100)+75:POKE 53249,X4:R
EM %% RANDOM HORIZONTAL POSITION FOR CLO
UD 2 %%
68 POKE 623,1:REM % SET PRIORITY BETWEEN
 PLAYERS AND PLAYFIELDS %
69 POKE 53278,255:REM % CLEAR COLLISION
DETECTION REGISTERS %
70 POKE 756,PEEK(203):SETCOLOR 3,3,4:REM
 % POINT TO NEW CHARCTER SET IN RAM INST
EAD OF ROM %
80 X=1:BASE$="#":CHUTE$=CHR$(ASC("%")+12
8)
85 REM %% PRINT BASE LINE %%
90 FOR P=0 TO 19
100 POSITION P,23
110 PRINT #6;LINE$;
120 NEXT P
130 BASE=INT(RND(0)%16)+2
140 POSITION BASE,22
```

```
150 ? #6;BASE$
155 REM ** MAIN PROGRAM LOOP **
160 POSITION X,0:? #6;PLANE$:POSITION X-
1,0:? #6;" "
170 X=X+1:IF X<19 THEN 190
180 POSITION X-1,0:? #6;" ":X=1
185 REM ** JOYSTICK ROUTINE **
190 S1=STICK(0):S2=STRIG(0)
191 X3=X3-3:IF X3<20 THEN X3=220
192 X4=X4+3:IF X4>220 THEN X4=20
193 POKE 53248,X3:POKE 53249,X4
200 IF MAN=0 AND S2=0 THEN GOSUB 1000
205 IF MAN=1 THEN LOCATE X2,Y2,Z
210 IF MAN=1 THEN POSITION X2,Y2:? #6;MA
N$
220 IF CHUTE=1 THEN POSITION X2,Y2-1:? #
6;CHUTE$:FOR P=1 TO 100:NEXT P
222 IF PEEK(53252)<>0 OR PEEK(53253)<>0
THEN 2080
225 IF Y2=22 AND MAN=1 THEN 2000
230 OX=X2:X2=X2+(S1=7)-(X2>18)
240 OY=Y2:X2=X2-(S1=11)+(X2<1):Y2=Y2+1
250 IF S1=13 AND MAN=1 AND CHUTE=0 AND Y
2<19 THEN CHUTE=1:FOR T=0 TO 50:SOUND 0,
T,120,15:NEXT T:SOUND 0,0,0,0:C=Y2
255 IF MAN=0 THEN 160
260 POSITION OX,OY-1:? #6;" "
270 POSITION OX,Y2-1:? #6;" "
280 GOTO 160
999 REM ** MAN OPENS CHUTE **
1000 MAN=1:Y2=2:X2=X
1010 FOR P=30 TO 0 STEP -2:SOUND 0,P,120
,15:NEXT P:SOUND 0,0,0,0:RETURN
2000 IF Z=ASC(BASE$) THEN GOTO 3000
2010 FOR G=0 TO 255
2020 SOUND 0,G,10,15:POKE 708,G
2030 NEXT G
2040 FOR G=255 TO 0 STEP -3
2050 SOUND 0,G,10,15:POKE 708,G
2060 NEXT G
2070 SOUND 0,0,0,0
```

```
2080 POSITION 0,0:POKE 708,104
2090 ? #6;">>>>>SPLAT<<<<<"
2095 ? #6;"SCORE:";SCORE
2100 ? #6:? #6;"PRESS start TO PLAY"
2110 POKE 53279,0
2120 IF PEEK(53279)<>6 THEN 2110
2130 RUN
3000 POSITION 0,0
3010 IF CHUTE=1 THEN 3500
3020 ? #6;"YOU DID NOT HAVE"
3030 ? #6;"your chute open"
3040 ? #6:? #6;"   OHCH ..."
3050 ? #6
3060 FOR P=0 TO 150 STEP 2
3070 SOUND 0,P,12,15
3080 NEXT P
3090 SOUND 0,0,0,0
3100 GOTO 2095
3500 ? #6;"well done ..."
3510 ? #6;"YOU MANAGED TO LAND"
3520 ? #6;"ON THE PAD WITH YOUR"
3530 ? #6;"CHUTE OPEN ..."
3540 POSITION 3,10:? #6;"score:"
3550 BONUS=C%75
3560 FOR P=0 TO BONUS STEP 5
3570 POSITION 9,10:? #6;SCORE+P
3580 SOUND 0,P%25,10,15
3590 NEXT P
3600 SCORE=SCORE+BONUS
3610 SOUND 0,0,0,0
3620 MAN=0:CHUTE=0:NEXT JUMP
3630 GRAPHICS 2:POKE 53248,0:POKE 53249,
0
3640 ? #6;"YOU'VE SUCCESSFULLY"
3650 ? #6;"  LANDED 10 TIMES"
3660 ? #6
3670 ? #6;"your final score :-"
3680 ? #6;"      ";SCORE
3690 SETCOLOR 2,0,0
3700 FOR P=5 TO 200 STEP 3
```

```
3710 FOR G=P-5 TO P+5
3720 SOUND 0,G,10,15
3730 NEXT G
3740 SETCOLOR 1,RND(0)*15,8
3750 NEXT P
3760 SOUND 0,0,0,0
3770 END
10000 RAM=PEEK(106)-8:A=256*RAM
10010 GRAPHICS 0
10020 SETCOLOR 4,9,2:SETCOLOR 2,9,2
10030 PRINT CHR$(127);"PLEASE WAIT A LIT
TLE WHILE"
10040 PRINT CHR$(127);"**********
*********"
10050 POKE 752,1:PRINT
10055 REM ** COPY CHARACTER SET FROM ROM
INTO RAM **
10060 FOR P=0 TO 1023
10070 POKE A+P,PEEK(57344+P)
10080 SOUND 0,PEEK(53770),10,2
10090 NEXT P:SOUND 0,0,0,0
10100 READ X
10110 IF X<0 THEN POKE 203,RAM:GOTO 1022
0
10120 FOR P=0 TO 7
10130 READ Y
10140 POKE (X*8)+A+P,Y
10150 NEXT P
10160 GOTO 10100
10165 REM ** DATA FOR REDEFINED CHARACTE
RS **
10170 DATA 1,153,189,153,126,60,60,66,12
9
10180 DATA 5,0,0,0,24,60,126,195,129
10190 DATA 3,255,255,255,255,255,255,255
,255
10200 DATA 6,16,8,132,194,255,2,4,8
10210 DATA -1
10220 R=RAM-8
10225 REM ** CLEAR OUT PLAYER MISSILE GR
APHICS MEMORY **
```

```
10230 FOR P=512 TO 768
10240 POKE R%256+P,0:NEXT P
10245 REM %% POKE IN DATA FOR CLOUD PLAY
ERS %%
10250 FOR P=0 TO 7
10260 READ X
10270 POKE R%256+70+P+512,X
10280 POKE R%256+50+P+640,X
10290 NEXT P
10300 POKE 204,R
10310 RETURN
10315 REM %% DATA FOR P.M. GRAPHICS %%
10320 DATA 16,126,127,255,126,62,28,8
```

TIC-TAC-TOE

(Keyboard)

This game, written by Roland Marriott, requires a machine with a 24K memory; it can be played either against the computer or a friend. To win you must get four squares of the same color in a row.

There are four planes from left to right, labeled A, B, C and D. To make your move, first type a plane letter (A-D). Then enter two digits to correspond with the position on the plane. They are numbered left to right from 01 to 16, like this:

13	14	15	16
09	10	11	12
05	06	07	08
01	02	03	04

Here are examples of moves, though you should note that RETURN does not have to be pressed:

D15
A05
B10
C02
B16

When you are asked how many players want to play, press "1" if you want to play against the computer, otherwise press "2."

```
0 REM ********************************
1 REM *  3D NOUGHTS AND CROSSES BY   *
2 REM *        ROLAND MARRIOTT       *
3 REM ********************************
4 GOSUB 3000
5 DIM SPACE(64,2):DIM MARK(64):DIM BLOB(
86,3):DIM HZ(40)
6 CL=0
7 GOSUB 6000
10 GRAPHICS 7+16:COLOR 1
17 SETCOLOR 2,12,8:SETCOLOR 4,0,3
18 SETCOLOR 1,4,8:SETCOLOR 0,2,6:SETCOLO
R 3,3,8
20 FOR X=0 TO 129 STEP 43
30 FOR Y=95 TO 30 STEP -1
40 PLOT X,Y:DRAWTO X+30,Y-30
50 NEXT Y
60 NEXT X
61 PLOT 0,28:DRAWTO 28,0:PLOT 0,27:DRAWT
O 27,0
62 FOR RT=0 TO 86 STEP 43
63 PLOT RT+41,95:DRAWTO RT+41,30:DRAWTO
RT+71,0:PLOT RT+40,95:DRAWTO RT+40,30:DR
AWTO RT+70,0
64 NEXT RT
65 COLOR 0:SETCOLOR 4,9,2
66 FOR Z=0 TO 129 STEP 43
70 FOR Y=91 TO 31 STEP -20
72 FOR X=1 TO 31 STEP 9
74 FOR A=0 TO 1
760 PLOT Z+X+A,Y-A-X+3:DRAWTO Z+X+A,Y-A-
X
780 NEXT A
850 NEXT X
900 NEXT Y
950 NEXT Z
1000 FOR P=1 TO 64:READ H,J
1010 SPACE(P,1)=H:SPACE(P,2)=J
1012 NEXT P
1015 IF PEEK(764)=255 THEN 1015
```

```
1016 CLOSE #1:OPEN #1,4,0,"K:":GET #1,W
1017 IF W<65 OR W>68 THEN POKE 764,255:G
OTO 1015
1018 IF W=65 THEN N=0:IF W=66 THEN N=16:
IF W=67 THEN N=32
1019 IF W=66 THEN N=16
1020 IF W=67 THEN N=32
1021 IF W=68 THEN N=48
1023 POKE 764,255
1024 IF PEEK(764)=255 THEN 1024
1025 CLOSE #5:OPEN #5,4,0,"K:":GET #5,Z
1026 IF Z<48 OR Z>49 THEN POKE 764,255:G
OTO 1024
1027 POKE 764,255
1028 CLOSE #4:OPEN #4,4,0,"K:":GET #4,WH
:IF WH<48 OR WH>57 THEN POKE 764,255:GOT
O 1027
1033 REM FOR TR=0 TO 2
1034 SP=N+10*(Z-48)+WH-48:LOCATE SPACE(S
P,1),SPACE(SP,2),GH:IF GH<>0 THEN GOTO 1
015
1035 CL=CL+1:IF CL=2 THEN CL=0
1036 FOR RY=15 TO 0 STEP -1:COLOR (RY+CL
+2):SETCOLOR 1,3,4
1037 FOR TR=0 TO 2
1038 PLOT SPACE(SP,1)+TR,SPACE(SP,2)-TR:
DRAWTO SPACE(SP,1)+TR,SPACE(SP,2)-TR-3
1039 NEXT TR:NEXT RY
1040 CLOSE #1
1042 FOR PQ=1 TO 64
1044 LOCATE SPACE(PQ,1),SPACE(PQ,2),V
1046 MARK(PQ)=V:NEXT PQ
1050 C=CL+2
1100 A=1:B=16:D=16:E=1:GOSUB 1400
1105 A=1:B=61:D=1:E=4:GOSUB 1400
1110 A=1:B=13:D=17:E=4:GOSUB 1400
1115 A=4:B=16:D=15:E=4:GOSUB 1400
1120 A=1:B=4:D=20:E=1:GOSUB 1400
1125 A=13:B=16:D=12:E=1:GOSUB 1400
1130 A=1:B=1:D=21:E=1:GOSUB 1400
1135 A=13:B=13:D=13:E=1:GOSUB 1400
```

```
1140 A=16:B=16:D=11:E=1:GOSUB 1400
1145 A=4:B=4:D=19:E=1:GOSUB 1400
1150 A=1:B=49:D=5:E=16:GOSUB 1400
1155 A=4:B=52:D=3:E=16:GOSUB 1400
1160 A=1:B=4:D=4:E=1:GOSUB 1400
1165 A=17:B=20:D=4:E=1:GOSUB 1400
1170 A=33:B=36:D=4:E=1:GOSUB 1400
1175 A=33:B=36:D=4:E=1:GOSUB 1400
1180 A=49:B=52:D=4:E=1:GOSUB 1400
1299 IF PLAYER=1 AND CL()0 THEN GOTO 150
0:REM IF CL=0 THEN GOTO 1015
1300 GOTO 1015
1400 FOR PQ=A TO B STEP E
1410 IF MARK(PQ)=C AND MARK(PQ+D)=C AND
MARK(PQ+2%D)=C AND MARK(PQ+3%D)=C THEN G
OSUB 1450
1420 NEXT PQ
1430 RETURN
1450 PLOT SPACE(PQ,1)+1,SPACE(PQ,2)-1:DR
AWTO SPACE(PQ+3%D,1)+1,SPACE(PQ+3%D,2)-1
:RETURN
1500 REM MACHINE LOGIC
1600 FOR PQ=1 TO 64
1605 LOCATE SPACE(PQ,1),SPACE(PQ,2),V
1606 IF V=2 THEN V=10
1608 IF V=3 THEN V=50
1610 MARK(PQ)=V:NEXT PQ
1615 H=0
1620 A=1:B=16:D=16:E=1:GOSUB 1700
1625 A=1:B=61:D=1:E=4:GOSUB 1700
1630 A=1:B=13:D=17:E=4:GOSUB 1700
1635 A=4:B=16:D=15:E=4:GOSUB 1700
1640 A=1:B=4:D=20:E=1:GOSUB 1700
1645 A=13:B=16:D=12:E=1:GOSUB 1700
1650 A=1:B=1:D=21:E=1:GOSUB 1700
1655 A=13:B=13:D=13:E=1:GOSUB 1700
1660 A=16:B=16:D=11:E=1:GOSUB 1700
1665 A=4:B=4:D=19:E=1:GOSUB 1700
1670 A=1:B=49:D=5:E=16:GOSUB 1700
1675 A=4:B=52:D=3:E=16:GOSUB 1700
1680 A=1:B=4:D=4:E=1:GOSUB 1700
```

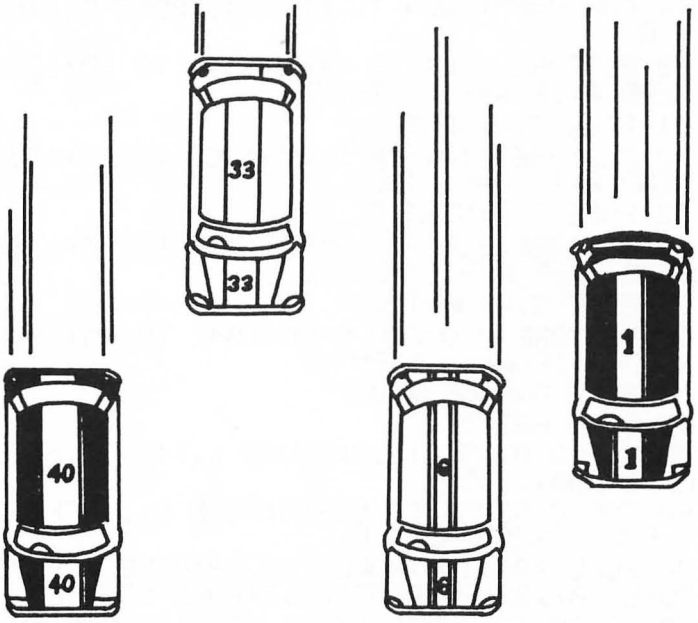
```
1682 A=17:B=20:D=4:E=1:GOSUB 1700
1686 A=33:B=36:D=4:E=1:GOSUB 1700
1688 A=49:B=52:D=4:E=1:GOSUB 1700
1690 GOTO 1740
1700 FOR PQ=A TO B STEP E
1705 H=H+1
1710 SUM=MARK(PQ)+MARK(PQ+D)+MARK(PQ+2%D
)+MARK(PQ+3%D)
1720 IF SUM=30 THEN GOTO 1830
1725 BLOB(H,1)=SUM:BLOB(H,2)=PQ:BLOB(H,3
)=D
1730 NEXT PQ:RETURN
1740 FOR TZ=1 TO H:IF BLOB(TZ,1)=150 THE
N GOTO 1850
1745 NEXT TZ
1746 YZ=0:FOR TZ=1 TO H
1748 IF BLOB(TZ,1)=20 OR BLOB(TZ,1)=100
THEN GOSUB 1860
1750 NEXT TZ:IF YZ<>0 THEN GOTO 1760
1755 GOTO 2050
1760 FOR TZ=1 TO YZ:FOR PZ=2 TO (YZ-1)
1765 IF HZ(TZ)=HZ(PZ) AND TZ<>PZ THEN SP
=HZ(TZ):GOTO 1035
1766 NEXT PZ:NEXT TZ
1770 IF YZ<>0 THEN SP=HZ(YZ):GOTO 1035
1825 GOTO 2050
1830 FOR TK=0 TO 3:IF MARK(PQ+TK%D)=0 TH
EN SP=PQ+TK%D:GOTO 1035
1835 NEXT TK
1850 REM DEFENCE
1855 FOR TK=0 TO 3:IF MARK(BLOB(TZ,2)+TK
%BLOB(TZ,3))=0 THEN SP=BLOB(TZ,2)+TK%BLO
B(TZ,3):GOTO 1035
1857 NEXT TK
1860 FOR P=0 TO 3
1863 IF MARK(BLOB(TZ,2)+P%BLOB(TZ,3))=0
THEN YZ=YZ+1:HZ(YZ)=BLOB(TZ,2)+P%BLOB(TZ
,3)
1865 NEXT P:RETURN
1890 GOTO 2050
1950 GOTO 2050
```

```
2050 SP=INT(64*RND(1)+1):IF MARK(SP)=0 T
HEN GOTO 1035
2055 GOTO 2050
3000 REM COVER PAGE
3020 GRAPHICS 2+16:SETCOLOR 4,13,2
3030 POSITION 3,1:? #6;"################"
3040 POSITION 3,2:? #6;"#  3D NOUGHTS #"
3050 POSITION 3,3:? #6;"# AND CROSSES #"
3052 POSITION 3,4:? #6;"#  BY  ROLAND #"
3054 POSITION 3,5:? #6;"#   MARRIOTT  #"
3060 POSITION 3,6:? #6;"################"
3070 POSITION 1,7:? #6;"PRESS start TO P
LAY"
3080 IF PEEK(53279)=6 THEN RETURN
3090 GOTO 3080
5000 DATA 1,93,10,84,19,75,28,66
5010 DATA 1,73,10,64,19,55,28,46
5020 DATA 1,53,10,44,19,35,28,26
5030 DATA 1,33,10,24,19,15,28,6
5040 DATA 44,93,53,84,62,75,71,66
5050 DATA 44,73,53,64,62,55,71,46
5060 DATA 44,53,53,44,62,35,71,26
5070 DATA 44,33,53,24,62,15,71,6
5080 DATA 87,93,96,84,105,75,114,66
5090 DATA 87,73,96,64,105,55,114,46
5100 DATA 87,53,96,44,105,35,114,26
5110 DATA 87,33,96,24,105,15,114,6
5120 DATA 130,93,139,84,148,75,157,66
5130 DATA 130,73,139,64,148,55,157,46
5140 DATA 130,53,139,44,148,35,157,26
5150 DATA 130,33,139,24,148,15,157,6
6000 GRAPHICS 2+16:? #6;"2 HUMAN PLAYERS
"
6010 ? #6;"OR 1 HUMAN VERSUS me"
6020 ? #6;" (TYPE 1 OR 2 )"
6030 OPEN #1,4,0,"K:":GET #1,M:IF M<49 O
R M>50 THEN POKE 764,255:CLOSE #1:GOTO 6
030
6040 PLAYER=M-48:CLOSE #1
6050 RETURN
```

RACE

(Joystick)

This game was written by Paul Dunning. In it you race against three other cars, all trying to cover as many miles as possible. Use the joystick to maneuver your car through the course. By pressing the red fire button on the joystick you can shift gears. The program uses machine code, so SAVE it before attempting to RUN the program.



```
0 REM %% ROAD RACE - WRITTEN BY %%
1 REM %%        PAUL DUNNING     %%
2 DIM S(4),G$(10),E$(100)
3 GRAPHICS 5:G$="LOW":POKE 752,1
5 GOSUB 1000
6 POKE 765,2:COLOR 2:PLOT 0,0:DRAWTO 79,
0:PLOT 79,47:DRAWTO 79,30:DRAWTO 0,30:PO
SITION 0,47:XIO 18,#6,0,0,"S:"
7 POKE 765,3:COLOR 3:PLOT 79,29:DRAWTO 7
9,1:DRAWTO 0,1:POSITION 0,29:XIO 18,#6,0
,0,"S:"
8 POKE 712,148
10 PP=PEEK(106)-16:POKE 54279,PP
20 PM=PP*256:POKE 559,62
21 FOR Q=53256 TO 53260:POKE Q,3:POKE Q-
8,RND(1)*255:NEXT Q
22 POKE 53248,100:POKE 53249,100:POKE 53
250,100:POKE 53251,50
23 POKE 704,109:POKE 705,89:POKE 706,79:
POKE 707,29:POKE 53277,3:POKE 559,62
24 FOR Q=PM+1024 TO PM+2048:POKE Q,0:NEX
T Q
30 RESTORE 210:FOR Q=PM+1144 TO PM+1280:
READ A:IF A=-1 THEN 32
31 POKE Q,A:NEXT Q
32 RESTORE 210:FOR Q=PM+1360 TO PM+1536:
READ A:IF A=-1 THEN 34
33 POKE Q,A:NEXT Q
34 RESTORE 210:FOR Q=PM+1576 TO PM+1792:
READ A:IF A=-1 THEN 36
35 POKE Q,A:NEXT Q
36 RESTORE 210:FOR Q=PM+1842 TO PM+2048:
READ A:IF A=-1 THEN 40
37 POKE Q,A:NEXT Q
40 POKE 623,1
50 SOUND 0,255,12,5:SOUND 1,145,12,5:SOU
ND 2,200,12,5
60 FOR Q=53256 TO 53260:POKE Q,3:POKE Q-
8,RND(1)*255:NEXT Q
70 POKE 704,109:POKE 705,89:POKE 706,79:
POKE 707,29:POKE 53277,3:POKE 559,62
75 ST=PM+1842:HG=INT(ST/256):LW=ST-256*H
G:POKE 203,LW:POKE 204,HG:POKE 205,10
```

```
80 P1=(RND(1)%100)+100:P2=(RND(1)%100)+1
00:P0=(RND(1)%100)+100:P3=50
85 FOR Q=0 TO 3:S(Q)=(RND(1)%2)+1:NEXT Q
87 POKE 53248,P0:POKE 53249,P1:POKE 5325
0,P2:POKE 53251,50
88 FOR Q=1 TO 50:X=USR(ADR(E$),7):NEXT Q
90 IF G$="HIGH" THEN GOSUB 400:GOTO 120
92 POKE 53278,1
95 P0=P0+S(0):IF P0>255 THEN P0=0
98 X=USR(ADR(E$),STICK(0))
100 P1=P1+S(1):IF P1>255 THEN P1=0
105 X=USR(ADR(E$),STICK(0))
110 P2=P2+S(2):IF P2>255 THEN P2=0
120 MI=MI+0.01
124 X=USR(ADR(E$),STICK(0))
129 IF STRIG(0)=0 THEN GOSUB 500
130 POKE 53248,P0:POKE 53249,P1:POKE 532
50,P2
135 POKE 656,2:POKE 657,5:? "GEAR ";G$;"
  ":POKE 656,2:POKE 657,20:? "MILES ";MI
;" "
140 CP=PEEK(53263):CS=PEEK(53255)
150 IF CP<>0 THEN 600
160 IF CS<>4 THEN 600
190 GOTO 90
210 DATA 64,228,238,238,238,238,78,68,22
9,245,255,255,233,255,255,233,255,255,24
5,229,68,78,238,238,238
215 DATA 238,238,64,-1
300 C=INT(RND(1)%3):S(C)=(RND(1)%2)+1:RE
TURN
400 P0=P0-(S(0)%2):IF P0<0 THEN P0=255
405 X=USR(ADR(E$),STICK(0))
410 P1=P1-(S(1)%2):IF P1<0 THEN P1=255
415 X=USR(ADR(E$),STICK(0))
420 P2=P2-(S(2)%2):IF P2<0 THEN P2=255
425 X=USR(ADR(E$),STICK(0))
430 MI=MI+0.05:RETURN
500 IF G$="HIGH" THEN G$="LOW":SOUND 0,2
55,12,10:SOUND 1,245,12,10:SOUND 2,235,1
2,10:RETURN
510 G$="HIGH":SOUND 0,100,12,10:SOUND 1,
```

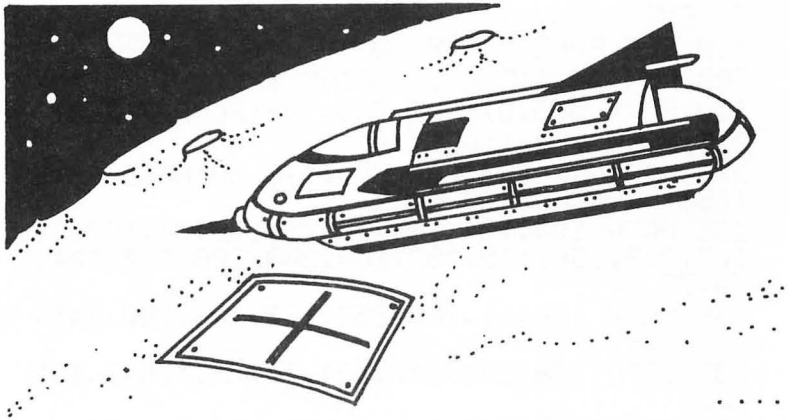
```
110,12,10:SOUND 2,90,12,10:RETURN
600 GOTO 640
605 SOUND 0,0,0,0:SOUND 1,0,0,0:SOUND 2,
0,0,0
610 POKE 53248,100:POKE 53249,100:POKE 5
3250,100
620 TRAP 620:? " ANOTHER GO ";:INPUT G$:
IF G$(1,1)="Y" THEN MI=0:G$="LOW":? CHR$
(125):GOTO 24
630 END
640 J=PEEK(203)+256*PEEK(204)
645 FOR Q=1 TO 250:IF PEEK(J+Q)=0 THEN N
EXT Q
650 ST=J+Q:HG=INT(ST/256):LW=ST-256*HG:P
OKE 203,LW:POKE 204,HG
655 FOR P=1 TO 60
660 X=USR(1536):SOUND 1,PEEK(53770),120,
15
670 POKE 707,PEEK(53770):NEXT P
700 POKE 53251,0:GOTO 605
1000 RESTORE 2000
1010 TRAP 1050:P=0
1020 P=P+1:READ A
1030 E$(P,P)=CHR$(A)
1040 GOTO 1020
1050 RESTORE 3000
1060 TRAP 1090:P=1536
1070 READ A:POKE P,A:P=P+1
1080 GOTO 1070
1090 TRAP 40000
1100 RETURN
2000 DATA 104,104,104,74,72,176,11,160,0
,177,203,136,145,203,200,200,208,247,104
,74,72
2010 DATA 176,11,160,0,177,203,200,145,2
03,136
2020 DATA 136,208,247,104,74,72,176,7,19
8,205,165
2030 DATA 205,141,3,208,104,74,176,7,230
,205,165,205,141,3,208,96,END
3000 DATA 104,160,0,173,10,210,145,203,2
00,192,25,208,246,96,END
```

LUNAR LANDING

(Joystick)

This game was also written by Paul Dunning. You use the joystick to land on the blue landing pad and score maximum points for a slow, gentle landing (say, a vertical speed of 5). You will crash if you are going too fast.

If you land, your score will depend on how slow your vertical speed was and on which landing pad you alighted. You are then given 500 extra fuel units and the game begins again. The game ends when you run out of fuel.



```
0 REM ** LUNAR LANDER BY PAUL DUNNING **
1 DATA 108,60,81,40,53,40,60,40,64,40,72
,40,40,40,53,40,60,40,64,40,72,40,40,40,
53,40,60,40,64,40,60,40,72,60
2 DATA 108,60,96,80,60,40,64,40,72,40,81
```

```
,80,72,40,64,40,72,60,96,40,85,40,53,80,
40,40,45,40,50,40,53,40,60,40
3 DATA 68,40,72,40,81,40,53,80,-1
4 CLR :DIM A$(100),H$(11),E$(60):H$="  a
tari":POKE 752,1:HI=500
5 AA=1:FU=4000:TI=100:SC=0:HV=0:VV=HV:PO
KE 53278,1:GOSUB 900:GOSUB 4000
6 DATA 11,12,13,13,14,15,17,19,21,22,23,
23,24
7 DATA 25,26,29,30,31,33,33,33,33,33,33,
31
8 DATA 31,30,29,28,26,25,25,24,23,21,18,
16,15
9 DATA 14,14,14,15,17,19,21,23,24,25,26,
27,29
10 DATA 29,29,29,29,27,26,26,25,26,27,28
,28
11 DATA 27,26,25,25,23,23,23,23,23,23,23
,21,21
12 DATA 20,18,17,17
29 FOR I=1 TO 8:POKE 53247+I,0:NEXT I:GO
TO 495
30 END
120 REM POKE 53248,30
200 REM *****PLAYER SETUP *****
210 POKE 559,0:POKE 710,148:POKE 712,0
215 POKE 752,1:AL=110
230 RESTORE 235:FOR S2=1 TO 60:READ S3:E
$(S2,S2)=CHR$(S3):NEXT S2
235 DATA 104,104,104,74,72,176,11,160,2,
177,203,136,145,203,200,200,208,247,104,
74,72
236 DATA 176,11,160,253,177,203,200,145,
203,136
237 DATA 136,208,247,104,74,72,176,7,198
,205
238 DATA 165,205,141,0,208,104,74,176,7,
230,205,165,205,141,0,208,96,0,0
240 A=PEEK(106)-16:POKE 54279,A:POKE 204
,A+4:POKE 203,0:PMBASE=A*256
250 POKE 53277,3:POKE 704,40:POKE 53248,
150:POKE 205,RND(1)*130+70:POKE 53256,0
260 FOR I=PMBASE+1024 TO PMBASE+1280:POK
```

```
E I,0:NEXT I
270 RESTORE 290
280 FOR I=PMBASE+1155 TO PMBASE+1209:REA
D B:POKE I,B:NEXT I
290 DATA 8,8,60,60,126,126,195,195,126,1
26,60,60,24,24,126,126,165,165
300 DATA 165,165,165,0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0
310 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
,0
320 POKE 559,62:GOTO 390
370 ST=STICK(0)
380 CO=PEEK(53252):IF CO>0 THEN GOSUB 50
0
385 POKE 53278,1
390 IF AA=1 THEN FOR Q=0 TO 100:A=USR(AD
R(E$),14):SOUND 0,255,8,15:NEXT Q:AA=0:A
=USR(ADR(E$),11):SOUND 0,0,0,0
400 POKE 53278,3
410 IF ST=14 AND FU>=30 THEN SOUND 0,255
,8,15:GOTO 420
415 SOUND 0,0,0,0
420 IF ST=7 OR ST=11 AND FU>=5 THEN SOUN
D 1,100,8,3:GOTO 430
425 SOUND 1,0,0,0
430 IF FU<=0 THEN FU=0:GOTO 455
431 IF ST=7 THEN HV=HV+0.05:FU=FU-5
432 IF ST=11 THEN HV=HV-0.05:FU=FU-5
440 HP=HP+HV:IF HP>1 THEN HP=0:SR=7
450 IF HP<-1 THEN HP=0:SR=11
455 VV=VV+0.02:VP=VP+VV:IF VP>1 AND SR=1
5 THEN VP=0:SR=13:AL=AL-1
456 IF VP>1 AND SR=11 THEN VP=0:SR=9:AL=
AL-1
457 IF VP>1 AND SR=7 THEN VP=0:SR=5:AL=A
L-1
458 IF VP<-1 THEN VP=0:SR=14:AL=AL+1
460 IF ST=14 AND FU>29 THEN VV=VV-0.05:F
U=FU-30
480 A=USR(ADR(E$),SR):SR=15
485 ? " SCORE=";SC;" ";CHR$(127);"  VVEL
=";VV*100;"     "
```

```
486 ? " FUEL =";FU;" ";CHR$(127);"  HUEL
=";HU%100;"    "
487 ? " TIME =";INT(TI);" ";CHR$(127);"
 ALT =";AL;" "
488 ? CHR$(28);CHR$(28);CHR$(28);
489 TI=TI-0.1
490 IF TI=0 THEN 720
492 GOTO 370
495 GOTO 210
500 IF CO=4 AND VV<0.5 THEN 600
505 IF CO=4 AND VV>0.4 THEN 700
510 IF CO=2 THEN 700
520 RETURN
600 FOR Q=1 TO 2:FOR W=255 TO 100 STEP -
1
610 SOUND 0,W,10,15:SOUND 1,W-10,10,15:S
OUND 2,W-20,10,15
620 NEXT W:NEXT Q
630 SS=0.5-VV:SO=SC:IF SS=0 THEN SC=SC+5
0:GOTO 650
640 IF AL<5 THEN SC=SC+(SS%100)%10:GOTO
650
642 IF AL<20 THEN SC=SC+(SS%100)%20:GOTO
 650
644 IF AL<60 THEN SC=SC+(SS%100)%5
650 IF FU<2500 THEN FU=FU+(SC-SO%2)
655 FOR Q=0 TO 3:SOUND Q,0,0,0:NEXT Q:AA
=1:POKE 53278,1:GOSUB 800:GOTO 210
700 FOR Q=0 TO 50:POKE 712,RND(1)%255:SO
UND 0,255,8,15:SOUND 1,240,8,15:SOUND 2,
220,8,15:NEXT Q
705 SOUND 0,0,0,0:SOUND 1,0,0,0:SOUND 2,
0,0,0
706 IF FU<30 THEN FU=0:GOTO 720
710 POKE 712,0:AA=1:GOSUB 800:GOTO 210
720 POKE 712,0:GOTO 810
800 VP=0:HP=0:HV=0:VV=0:TI=100:RETURN
810 IF SC>HI THEN GOSUB 1010
820 GRAPHICS 17:SETCOLOR 4,1,0
830 ? #6;"      GAME OVER"
835 ? #6:? #6;"  HIGH SCORE ";HI
836 ? #6:? #6;"     ";H$
```

```
840 ? #6:? #6;"    PRESS START "
850 POKE 53248,0
860 IF PEEK(53279)=6 THEN RESTORE :GOTO
5
870 GOTO 860
899 END
900 REM INTRO
910 GRAPHICS 17:SETCOLOR 4,1,0:E=0
920 ? #6;"    LUNAR LANDER "
930 ? #6:? #6;" BY P.DUNNING SEP.82"
940 ? #6:? #6;"  USE JOYSTICK (0)"
950 ? #6:? #6;"          U P        "
960 ? #6:? #6;"           ^ "
970 ? #6;" left  <    >   right"
980 ? #6
985 POKE 53248,0
990 READ M:IF M<0 THEN 998
992 READ P
995 SOUND 0,M,10,15:FOR PP=0 TO P:NEXT P
P
997 GOTO 990
998 ? #6;"      good luck"
999 FOR X=1 TO 13:FOR Y=0 TO 255 STEP 20
:SOUND 0,Y,10,15:NEXT Y:NEXT X:SOUND 0,0
,0,0:RETURN
1000 RESTORE 1:GOTO 990
1010 H$=" ":TI=30:GRAPHICS 18:SETCOLOR 4
,1,0:? #6;"    GREAT SCORE ":? #6:X=1:Y=
1:HI=SC
1011 ? #6;"  a b c d e f g h "
1012 ? #6
1013 ? #6;"  i j k l m n o p "
1014 ? #6
1015 ? #6;"  q r s t u v w x "
1016 ? #6
1017 ? #6;"  y z . -      R E "
1018 POKE 53248,0
1020 FOR Q=10 TO 245:SOUND 0,Q-10,8,15:S
OUND 1,Q,8,15:SOUND 2,Q+10,8,15:NEXT Q
1030 POSITION X,Y:? #6;"XXX":POSITION X,
Y+1:? #6;"X":POSITION X+2,Y+1:? #6;"X":P
```

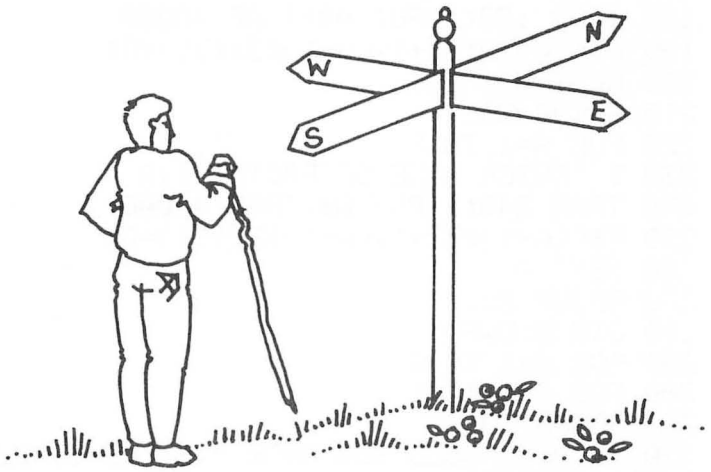
```
OSITION X,Y+2:? #6;"XXX"
1040 IF STICK(0)<>7 THEN 1050
1045 POSITION X,Y:? #6;"   ":POSITION X,
Y+1:? #6;" ":POSITION X+2,Y+1:? #6;" ":P
OSITION X,Y+2:? #6;"   "
1046 IF X>13 AND Y=7 THEN X=1:Y=1:GOTO 1
050
1047 IF X>13 THEN X=1:Y=Y+2:GOTO 1050
1048 X=X+2
1050 IF STICK(0)<>11 THEN 1060
1055 POSITION X,Y:? #6;"   ":POSITION X,
Y+1:? #6;" ":POSITION X+2,Y+1:? #6;" ":P
OSITION X,Y+2:? #6;"   "
1056 IF X<3 AND Y=1 THEN X=15:Y=7:GOTO 1
060
1057 IF X<3 THEN X=15:Y=Y-2:GOTO 1060
1058 X=X-2
1060 POSITION 6,10:? #6;"TIME ";INT(TI);
" ":TI=TI-0.1:IF TI=0 THEN 1100
1065 FOR PP=0 TO 20:NEXT PP
1069 IF STRIG(0)<>0 THEN 1080
1071 LOCATE X+1,Y+1,XX:IF XX=ASC("E") TH
EN 1100
1072 IF XX=ASC("R") AND LEN(H$)>1 THEN H
$=H$(1,LEN(H$)-1):GOTO 1080
1073 IF LEN(H$)>10 THEN 1080
1075 H$(LEN(H$)+1)=CHR$(XX)
1080 POSITION 4,11:? #6;H$;" "
1099 GOTO 1030
1100 FOR Q=0 TO 3:SOUND Q,0,0,0:NEXT Q
1110 RETURN
4000 GRAPHICS 5
4010 RESTORE 6:COLOR 2
4020 FOR X=0 TO 79
4030 READ Y
4040 PLOT X,39:DRAWTO X,Y
4050 NEXT X
4060 COLOR 3
4070 PLOT 18,32:DRAWTO 23,32
4080 PLOT 50,28:DRAWTO 54,28
4090 PLOT 67,22:DRAWTO 73,22
4100 RETURN
```

DECISION MAKER

(Keyboard)

This program will help you to make up your mind about something. First it asks how many options there are that you cannot decide between. Then it asks how many factors influence your decision (e.g. price, quality, size). You are then asked how you might rate a factor, which you do by typing in a number between 0 and 100.

After all data is entered and all options are listed, the one that the computer thinks you should choose is shown in inverse video.



```
10 REM %% DECISION MAKER II  %%
20 REM %% BY CHRIS CALLENDER %%
21 REM %% ADAPTED BY P.BUNN  %%
22 REM %%%%%%%%%%%%%%%%%%%%%%%
25 DIM A$(32):GOSUB 30:GOTO 80
30 GRAPHICS 0
40 SETCOLOR 2,8,2:SETCOLOR 4,8,2
50 PRINT ,"DECISION MAKER"
60 PRINT ,"%%%%%%%%%%%%%%"
70 PRINT
75 RETURN
80 PRINT "HOW MANY OPTIONS TO CHOOSE FRO
M"
82 TRAP 82:INPUT A$:O=VAL(A$)
90 PRINT "HOW MANY FACTORS INFLUENCE DEC
ISION"
100 TRAP 100:INPUT A$
110 F=VAL(A$)
120 DIM O$(O%32),F$(F%32)
130 O$(1)=" ":O$(O%32)=" ":O$(2)=O$
140 F$(1)=" ":F$(F%32)=" ":F$(2)=F$
150 GOSUB 30
160 FOR A=1 TO O
170 ? "ENTER NAME OF OPTION ";A
180 TRAP 180:INPUT A$:TRAP 40000
190 O$((A-1)%32+1,(A-1)%32+31)=A$
200 NEXT A
210 GOSUB 30
220 FOR A=1 TO F
230 ? "ENTER NAME OF FACTOR ";A
240 TRAP 240:INPUT A$:TRAP 40000
250 F$((A-1)%32+1,(A-1)%32+31)=A$
260 NEXT A
270 GOSUB 30
280 DIM M(O,F)
290 FOR A=1 TO O
300 FOR B=1 TO F
310 GOSUB 30
320 ? "HOW WOULD YOU RATE ";F$((B-1)%32+
1,(B-1)%32+31)
```

```
330 ? "ON THE ";O$((A-1)%32+1,(A-1)%32+3
1)
340 INPUT V
350 M(A,B)=V
360 NEXT B
370 NEXT A
380 GOSUB 30
390 ? "HERE IS WHAT I THINK YOU SHOULD D
O:-"
400 FOR A=1 TO O
410 C=0
420 FOR B=1 TO F
430 C=C+M(A,B)
440 NEXT B
450 IF C>TOP THEN TOP=C:NO=A
460 NEXT A
470 FOR A=1 TO O
480 IF A=NO THEN FOR P=1 TO 31:L=(A-1)%3
2+P:A$=O$(L,L):K=ASC(A$)+128:O$(L,L)=CHR
$(K):NEXT P
485 IF A=NO THEN FOR P=1 TO 31:L=(A-1)%3
2+P:K=ASC(O$(L,L)):IF K=160 THEN O$(L,L)
=" "
486 IF A=NO THEN NEXT P
490 ? O$((A-1)%32+1,(A-1)%32+31)
500 NEXT A
```

SAFE CRACKER

(Keyboard)

This superb game was written by Terry Davies, and it requires a machine with a 24K memory.

The object is to get as many coins from Mrs. Warren Fitzdobody's safes as possible. To open a safe, you must guess three numbers correctly. You enter your first number when asked, and if you are within ± 5 of the actual number, you will hear the safe mechanism click. If you take more than 10 guesses for any number, the alarm is triggered and the police will arrive (you will see the flash of their headlights through the window).

If you get the first number right, proceed to number two and then three. If you manage to guess all three numbers correctly (a probability of 1 in 970,299) the safe will open and you will receive some coins. You then proceed to another room and try again.

Luck is involved in this game, but so too is skill. The skill involves learning the logic to crack the safe. After playing this game, you may think twice before practicing this art for real!

```
1 REM ********************************
2 REM ** SAFE CRACKER  -            **
3 REM **   WRITTEN BY TERRY DAVIES **
4 REM ********************************
5 GRAPHICS 2:FLASH=0:P=10:DIM A$(5),D$(3
200),C(4),PT$(62):TT=0
10 POKE 708,P+10:POKE 709,145:POKE 752,8
:POKE 712,145:POKE 710,145
15 ? "                press start "
20 POSITION 4,4:? #6;"SAFE CRACKER"
```

```
25 POSITION 4,6:? #6;"safe cracker":GOSU
B 6000
30 IF PEEK(53279)=6 THEN 1000
35 P=P+0.1:FLASH=FLASH+1:IF FLASH>50 THE
N POKE 709,P:IF FLASH>50 THEN POKE 708,1
45:FLASH=-20:POKE 53279,0
40 IF FLASH=0 THEN POKE 709,145:IF FLASH
=0 THEN POKE 708,P:POKE 53279,0
50 IF P<200 THEN 30
1000 GRAPHICS 7:PX=4:LC=40:X=0:Y=0
1005 GOSUB 5100
1007 ? "PLEASE WAIT."
1010 GOSUB 30000
1020 FOR I=0 TO 4:POKE 708+I,C(I):NEXT I
1030 GOSUB 5199
1040 POKE 752,1:POKE 709,0:? :? "     HE
RE IS THE SAFE...SHHHHHH!!!":FOR W=1 TO
1500:NEXT W:? CHR$(125)
1043 ? " YOU BETTER PUT THE SIDE LIGHT O
N":? " THERE'S NO ONE AROUND..PRESS STAR
T":POKE 53279,0
1045 IF PEEK(53279)<>6 THEN 1045
1050 POKE 709,202:? CHR$(125);"THAT'S BE
TTER YOU CAN SEE WHAT YOU":? "ARE DOING
NOW":FOR W=1 TO 2000:NEXT W
1055 ? CHR$(125):GOTO 2000
1060 GOSUB 6000
1070 ? CHR$(125);"PRESS START TO HAVE AN
OTHER CRACK"
1071 POKE 710,30:FOR W=1 TO 200:NEXT W:P
OKE 710,138:FOR W=1 TO 99:NEXT W:POKE 71
0,148:FOR W=1 TO 250:POKE 710,138
1072 FOR W=1 TO 99:NEXT W:POKE 710,148:F
OR W=1 TO 250:NEXT W:POKE 710,138:FOR W=
1 TO 100:NEXT W:POKE 710,148
1073 FOR W=1 TO 250:NEXT W:POKE 710,138:
FOR W=1 TO 100:NEXT W:POKE 710,148
1074 POKE 53279,0:IF PEEK(53279)<>6 THEN
 1072
1075 GOTO 1020
2000 A=INT(RND(1)*81)+10:B=INT(RND(1)*81
)+10:C=INT(RND(1)*81)+10:J=0
2003 J=J+1:? "  WHATS YOUR FIRST NUMBER
```

```
1 TO 99 ":INPUT N:IF N>99 OR N<1 THEN 20
03
2005 IF J=11 THEN GOSUB 3950:GOTO 1060
2006 IF N<>A THEN 2008
2007 GOSUB 3850:GOTO 2499
2008 IF N>A-5 AND N<A+5 THEN GOSUB 3900:
GOTO 2003
2010 IF N>A+5 OR N<A-5 THEN GOSUB 4000:G
OTO 2003
2011 GOTO 2003
2499 J=0
2500 J=J+1:? "WHATS YOUR SECOND NUMBER":
INPUT N:IF N>99 OR N<0 THEN 2500
2510 IF J=11 THEN GOSUB 3950:GOTO 1060
2520 IF N<>B THEN 2530
2525 GOSUB 3850:GOTO 2999
2530 IF N>B-5 AND N<B+5 THEN GOSUB 3900:
GOTO 2500
2535 IF N>B+5 OR N<B-5 THEN GOSUB 4000:G
OTO 2500
2540 GOTO 2500
2999 J=0
3000 ? "  WHATS YOUR THIRD NUMBER":INPUT
 N:IF N>99 OR N<0 THEN 3000
3005 J=J+1
3010 IF J=11 THEN GOSUB 3950:GOTO 1060
3020 IF N<>C THEN 3030
3025 GOSUB 3850:? "YOU HAVE OPENED THE S
AFE":J=0:COLOR 0:PLOT 41,30:DRAWTO 39,16
3026 J=J+1:IF J>9 THEN 3028
3027 DRAWTO 41+J,16:DRAWTO 41+J,30:GOTO
3026
3028 CO=INT(RND(0)*200)+100:? CHR$(125);
"WELL DONE , THERE WAS ";CO;" COINS IN":
? "THAT SAFE !!....."
3029 TT=TT+CO:? "NOW TRY THIS ONE.....":
FOR W=1 TO 1000:NEXT W:GOTO 1020
3030 IF N>C-5 AND N<C+5 THEN GOSUB 3900:
GOTO 3000
3035 IF N>C+5 OR N<C-5 THEN GOSUB 4000:G
OTO 3000
3040 GOTO 3000
```

```
3850 FOR T=1 TO 100:SOUND 0,T,10,8:NEXT
T:? "YOU ARE RIGHT":SOUND 0,0,0,0:RETURN

3900 FOR S=20 TO 15 STEP -4:NEXT S:SOUND
 0,N,10,14:FOR W=1 TO 3:NEXT W:SOUND 0,0
,0,0:RETURN
3950 ? "BLIMEY  !! YOU HAVE SET THE ALAR
M OFF":? "LETS SCARPER....THE POLICE ":R
=0
3960 ? "YOU NICKED ";TT;" COINS FROM THE
 SAFES";:TT=0
3998 FOR N=20 TO 15 STEP -4:NEXT N:SOUND
 0,N,10,14:FOR W=1 TO 33:NEXT W:SOUND 0,
0,0,0:R=R+1:IF R=20 THEN RETURN
3999 GOTO 3998
4000 ? "    YOU ARE WRONG TRY AGAIN !":R
ETURN
5100 DL=PEEK(560)+PEEK(561)*256:MEM=PEEK
(106)*256:DAT=PEEK(DL+4)+256*PEEK(DL+5)
5108 RESTORE 5200:FOR P=1 TO 62:READ A:P
T$(P,P)=CHR$(A):NEXT P
5110 ST=DAT+Y*LC+INT(X/PX):RETURN
5199 GOSUB 5110:A=USR(ADR(PT$),ST,ADR(D$
),BYT,LIN,LC):RETURN
5200 DATA 104,104,133,204,104,133,203,10
4,133,206,104,133,205,104,104,133,207,10
4,104
5210 DATA 170,104,104,133,208,164,207,13
6,177,205
5220 DATA 145,203,136,192,255,208,247,24
,165
5230 DATA 203,101,208,133,203,144,2,230,
204,24,165,205,101,207,133,205,144,2,230
5240 DATA 206,202,208,219,96
6000 FOR J=1 TO 8:SOUND 0,47,10,8:FOR L=
1 TO 100:NEXT L:SOUND 0,64,10,8:FOR L=1
TO 100:NEXT L:NEXT J
6001 SOUND 0,0,0,0:RETURN
20000 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20001 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20002 DATA 0,0,0,12,0,0,0,0,0,0,0,0,0,0,
0
20003 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,195
```

```
,0
20004 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,0
20005 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20006 DATA 0,0,0,0,0,0,0,0,195,12,63,255
,207,255,63
20007 DATA 255,207,255,63,255,207,255,19
2,192,192,0,0,0,0,0
20008 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20009 DATA 0,0,0,195,12,63,255,207,255,6
3,255,207,255,63,255
20010 DATA 207,255,192,192,192,0,0,0,0,0
,0,0,0,0,0
20011 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,195
,12
20012 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,192
20013 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20014 DATA 0,0,0,0,0,0,0,0,195,12,63,255
,207,255,63
20015 DATA 255,207,255,63,255,207,255,19
2,192,192,0,0,0,0,0
20016 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20017 DATA 0,0,0,195,12,63,255,207,255,6
3,255,207,255,63,255
20018 DATA 207,255,192,192,192,0,0,0,0,0
,0,0,0,0,0
20019 DATA 0,0,0,0,0,0,63,255,207,255,19
2,0,0,195,12
20020 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,192
20021 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20022 DATA 0,63,255,207,255,192,0,0,195,
12,63,255,207,255,63
20023 DATA 255,207,255,63,255,207,255,19
2,192,192,0,0,0,0,0
20024 DATA 0,0,0,0,0,0,0,0,0,0,0,63,255,
207,255
20025 DATA 192,0,0,195,12,0,0,0,0,0,0,0,
0,0,0
20026 DATA 0,0,0,192,192,0,0,0,0,0,0,0,0
,0,0
20027 DATA 0,0,0,0,0,0,63,255,207,255,19
```

```
2,0,0,195,12
20028 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,192
20029 DATA 0,0,0,0,0,0,0,0,0,3,255,255,2
40,0,0
20030 DATA 0,63,255,207,255,192,0,0,195,
12,63,255,207,255,63
20031 DATA 255,207,255,63,255,207,255,19
2,192,192,0,0,0,0,0
20032 DATA 85,85,85,85,92,0,0,12,0,0,0,6
3,255,207,255
20033 DATA 192,0,0,195,12,63,255,207,255
,63,255,207,255,63,255
20034 DATA 207,255,192,192,192,0,0,0,0,0
,85,85,85,85,92
20035 DATA 0,0,12,0,0,0,63,255,207,255,1
92,0,0,195,12
20036 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,192
20037 DATA 0,0,0,0,0,80,0,0,0,48,0,0,3,0
,0
20038 DATA 0,63,255,207,255,192,0,0,195,
12,63,255,207,255,63
20039 DATA 255,207,255,63,255,207,255,19
2,192,192,0,0,0,0,0
20040 DATA 80,0,0,0,192,0,0,3,0,1,85,85,
85,80,0
20041 DATA 0,0,0,195,12,63,255,207,255,6
3,255,207,255,63,255
20042 DATA 207,255,192,192,192,0,0,0,0,0
,80,3,195,3,0
20043 DATA 0,0,0,192,1,64,63,255,240,255
,192,0,0,195,12
20044 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,192
20045 DATA 0,0,0,0,0,80,16,51,3,0,0,0,0,
192,1
20046 DATA 69,85,85,240,255,192,0,0,195,
12,0,0,0,0,0
20047 DATA 0,0,0,0,0,0,0,0,192,192,0,0,0
,0,0
20048 DATA 80,4,192,12,0,0,0,0,48,1,69,8
5,85,240,255
```

```
20049 DATA 192,0,0,195,12,63,255,207,255
,63,255,207,255,63,255
20050 DATA 207,255,192,192,192,0,0,0,0,0
,80,85,192,48,0
20051 DATA 0,0,0,12,1,69,81,85,240,255,1
92,0,0,195,12
20052 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,192
20053 DATA 0,0,0,0,0,88,68,3,192,0,0,0,0
,12,1
20054 DATA 69,85,85,240,255,192,0,0,195,
12,63,255,207,255,63
20055 DATA 255,207,255,63,255,207,255,19
2,192,192,0,0,0,0,0
20056 DATA 88,20,192,192,0,0,0,0,3,1,69,
85,85,240,255
20057 DATA 192,0,0,195,12,63,255,207,255
,63,255,207,255,63,255
20058 DATA 207,255,192,192,192,3,192,0,0
,0,88,16,195,0,0
20059 DATA 0,0,0,3,1,69,85,85,240,255,19
2,0,0,195,12
20060 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,192,192
20061 DATA 48,0,0,0,0,88,80,0,170,170,17
0,170,170,170,194
20062 DATA 69,0,85,240,0,0,0,0,195,12,63
,255,207,255,63
20063 DATA 255,207,255,63,255,207,255,19
2,192,195,0,0,0,0,0
20064 DATA 88,64,192,0,88,2,64,0,0,2,69,
85,85,240,255
20065 DATA 192,0,0,195,12,63,255,207,255
,63,255,207,255,63,255
20066 DATA 207,255,192,192,240,0,0,0,0,0
,88,76,12,192,88
20067 DATA 2,64,0,0,2,69,85,85,240,255,1
92,0,0,195,12
20068 DATA 63,255,207,255,63,255,207,255
,63,255,207,255,192,195,0
20069 DATA 0,0,0,0,0,88,0,0,0,88,2,64,0,
0,2
20070 DATA 69,85,85,240,255,192,0,0,195,
```

```
12,0,0,192,0,0
20071 DATA 0,0,0,0,12,0,0,0,240,192,0,0,
0,0,0
20072 DATA 88,0,0,0,88,2,64,0,0,2,69,85,
85,240,255
20073 DATA 192,0,0,195,12,63,255,255,255
,63,255,207,255,60,15
20074 DATA 207,255,207,0,0,0,0,0,0,0,88,
0,0,0,88
20075 DATA 2,64,0,0,2,69,85,85,240,255,1
92,0,0,3,12
20076 DATA 63,255,207,255,63,255,207,255
,56,15,207,255,240,192,0
20077 DATA 0,0,0,0,0,90,170,170,170,88,2
,64,0,0,2
20078 DATA 69,85,85,240,255,192,0,0,3,12
,63,255,207,255,63
20079 DATA 255,207,255,56,15,207,255,0,0
,192,0,0,0,0,0
20080 DATA 85,85,85,85,88,2,64,0,0,2,74,
255,255,240,255
20081 DATA 192,0,0,3,12,63,255,207,255,6
3,255,207,255,56,15
20082 DATA 207,240,192,0,192,0,0,0,0,0,0
,0,0,0,0
20083 DATA 2,64,0,0,2,85,85,85,80,255,19
2,0,0,3,12
20084 DATA 63,255,207,255,63,255,207,255
,56,15,207,12,3,192,192
20085 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20086 DATA 0,0,0,0,0,0,0,0,3,12,63,255,2
07,255,63
20087 DATA 255,207,255,56,15,192,0,3,192
,192,0,0,0,0,0
20088 DATA 0,0,0,0,0,2,64,0,0,0,0,63,255
,207,255
20089 DATA 192,0,0,3,12,63,255,207,255,6
3,255,207,255,56,12
20090 DATA 0,0,195,192,192,0,0,0,0,0,0,0
,0,0,0
20091 DATA 2,64,0,0,0,0,63,255,207,255,1
92,0,0,3,12
```

```
20092 DATA 0,0,0,0,0,0,0,0,8,0,0,12,3,19
2,192
20093 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20094 DATA 0,63,255,207,255,192,0,0,3,15
,255,255,255,255,255
20095 DATA 255,255,255,251,12,60,255,195
,192,192,0,0,0,0,0
20096 DATA 0,0,0,0,0,2,64,0,0,0,0,63,255
,207,255
20097 DATA 192,0,0,3,12,0,0,0,0,0,0,0,0,
11,0
20098 DATA 12,12,3,192,192,0,0,0,0,0,0,0
,0,0,0
20099 DATA 2,64,0,0,0,0,63,255,207,255,1
92,0,0,3,12
20100 DATA 0,0,0,0,0,0,0,0,11,0,12,12,3,
192,192
20101 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20102 DATA 0,63,255,207,255,192,0,0,3,12
,0,0,0,0,0
20103 DATA 0,0,0,11,12,12,12,3,192,192,0
,0,0,0,0
20104 DATA 0,0,0,0,0,2,64,0,0,0,0,63,255
,207,255
20105 DATA 192,0,0,3,12,0,0,0,0,0,0,0,0,
11,12
20106 DATA 12,12,3,192,192,0,0,0,0,0,0,0
,0,0,0
20107 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,3,
12
20108 DATA 0,0,0,0,0,0,0,0,11,12,12,12,3
,192,192
20109 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20110 DATA 0,0,0,0,0,0,0,0,3,12,0,0,0,0,
0
20111 DATA 0,0,0,11,12,12,12,3,192,192,0
,0,0,0,0
20112 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20113 DATA 0,0,0,3,12,0,0,0,0,0,0,0,0,11
```

```
,12
20114 DATA 12,12,3,192,192,0,0,0,0,0,0,0
,0,0,0
20115 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,3,
12
20116 DATA 0,0,0,0,0,0,0,0,11,12,12,12,3
,192,192
20117 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20118 DATA 0,0,0,0,0,0,0,0,3,12,0,0,0,0,
0
20119 DATA 0,0,0,11,12,12,12,3,192,192,0
,0,0,0,0
20120 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20121 DATA 0,0,0,3,12,0,0,0,0,0,0,0,0,11
,12
20122 DATA 12,12,3,192,192,0,0,0,0,0,0,0
,0,0,0
20123 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,3,
12
20124 DATA 0,0,0,0,0,0,0,0,11,12,12,12,3
,192,192
20125 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20126 DATA 0,0,0,0,0,0,0,0,3,12,0,0,0,0,
0
20127 DATA 0,0,0,11,12,12,12,3,192,192,0
,0,0,0,0
20128 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20129 DATA 0,0,0,3,12,0,0,0,0,0,0,0,0,11
,12
20130 DATA 12,63,255,192,192,0,0,0,0,0,0
,0,0,0,0
20131 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,3,
12
20132 DATA 0,0,0,0,0,0,0,0,11,12,12,51,1
92,252,63
20133 DATA 192,195,195,15,192,0,0,0,0,0,
2,64,0,0,0
20134 DATA 0,0,0,0,0,0,0,0,3,12,0,0,0,0,
0
```

```
20135 DATA 0,0,0,7,12,12,48,252,192,192,
0,0,0,0,0
20136 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20137 DATA 0,0,0,3,0,63,243,252,255,63,2
07,243,240,247,12
20138 DATA 207,240,15,192,48,0,0,0,0,0,0
,0,0,0,0
20139 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,0,
0
20140 DATA 0,0,0,0,0,0,0,0,7,12,12,48,3,
192,0
20141 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20142 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20143 DATA 0,0,0,7,11,255,252,0,240,0,0,
0,0,0,0
20144 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20145 DATA 0,0,0,0,0,15,255,63,207,207,2
43,252,255,55,2
20146 DATA 192,12,0,63,0,0,0,0,0,0,0,0,0
,0,0
20147 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,0,
0
20148 DATA 0,0,0,0,0,0,0,0,4,2,176,0,48,
15,192
20149 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
0
20150 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20151 DATA 0,0,0,7,0,172,0,0,0,240,0,0,0
,0,0
20152 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20153 DATA 0,0,0,0,0,0,255,243,252,252,2
52,255,63,199,192
20154 DATA 40,0,3,0,12,0,0,0,0,0,42,170,
170,170,170
20155 DATA 170,170,170,165,85,85,85,85,8
5,85,255,255,255,0,0
20156 DATA 0,0,0,0,0,0,0,0,4,51,10,0,0,0
,3
20157 DATA 0,0,0,0,0,0,0,0,0,0,2,64,0,0,
```

```
0
20158 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20159 DATA 0,0,0,4,12,194,128,0,48,0,240
,0,0,0,0
20160 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20161 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,3
20162 DATA 0,160,0,0,0,12,0,0,0,0,0,0,0,
0,0
20163 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,0,
0
20164 DATA 0,0,0,0,0,0,0,0,0,0,48,40,0,3
,0
20165 DATA 3,255,255,255,252,0,0,0,0,0,2
,64,0,0,0
20166 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20167 DATA 0,0,0,0,0,12,10,0,0,192,3,192
,0,0,0
20168 DATA 0,0,0,0,0,2,64,0,0,0,0,0,0,0,
0
20169 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20170 DATA 51,0,128,0,48,3,192,0,0,0,0,0
,0,0,0
20171 DATA 2,64,0,0,0,0,0,0,0,0,0,0,0,0,
0
20172 DATA 0,0,3,0,0,0,0,0,0,0,12,0,32,0
,15
20173 DATA 3,192,0,0,0,0,0,0,10,170,170,
170,170,160,0
20174 DATA 0,2,168,10,170,130,128,21,72,
70,5,143,197,223,255
20175 DATA 243,255,0,0,0,3,0,8,0,0,195,1
92,0,0,0
20176 DATA 0,0,0,42,170,170,170,170,168,
0,0,42,128,154,106
20177 DATA 0,5,85,69,65,127,0,0,0,0,0,0,
0,0,0
20178 DATA 0,192,2,0,0,51,192,0,0,0,0,0,
2,170,170
20179 DATA 170,170,170,170,128,2,170,130
,170,168,6,138,21,21,71
20180 DATA 213,255,255,223,207,240,255,2
52,0,0,0,48,0,128,0
```

```
20181 DATA 15,192,0,0,0,0,0,0,0,0,0,0,0,
0,0
20182 DATA 43,248,60,42,195,254,63,255,2
55,245,89,81,85,255,204
20183 DATA 243,63,252,0,0,0,12,0,32,0,3,
192,0,0,0
20184 DATA 0,0,0,0,0,0,0,0,0,0,168,32,5,
22,2
20185 DATA 168,42,170,21,79,245,0,0,0,4,
4,1,63,0,0
20186 DATA 0,3,0,11,255,255,192,0,0,0,0,
0,0,0,0
20187 DATA 0,0,0,0,42,170,138,170,170,42
,168,165,85,255,245
20188 DATA 127,241,63,255,207,207,207,25
5,192,0,0,0,192,12,0
20189 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,2,1
70
20190 DATA 168,10,170,168,170,160,1,84,1
65,70,5,81,85,95,207
20191 DATA 207,207,255,240,0,0,0,0,12,0,
0,0,0,0,0
20192 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20193 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20194 DATA 0,0,48,12,0,0,0,0,0,0,0,0,0,0
,0
20195 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20196 DATA 0,0,0,0,0,0,0,0,0,0,0,0,12,12
,0
20197 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20198 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20199 DATA 0,0,0,0,0,0,0,3,12,0,0,0,0,0,
0
20200 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20201 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20202 DATA 0,0,0,204,0,0,0,0,0,0,0,0,0,0
,0
20203 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20204 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,48,
0
20205 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20206 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

```
20207 DATA 0,0,0,0,0,0,0,0,12,0,0,0,0,0,
0
20208 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20209 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
20210 DATA 0,0,0,0,12,0,0,0,0,0,0
30000 BYT=40:LIN=79:GR=7:C(0)=6:C(1)=0:C
(2)=148:C(3)=70:C(4)=0
30010 RESTORE 20000:FOR P=1 TO 3143
30020 READ A:D$(P,P)=CHR$(A)
30030 NEXT P
30040 RETURN
```

TANK BATTLE

(Two joysticks)

In this game, designed for two players, you move your tank and fire so as to destroy your opponent. This gives you one point. Pushing the joystick up activates the tank's engines and propels it forward. Push the joystick left and right to turn left and right, respectively. Push the red button to fire. Good hunting!

```
1 REM ********************************
2 REM *          TANK BATTLE         *
3 REM *          -----------         *
4 REM *     Written by Paul Bunn     *
5 REM ********************************
6 REM
10 DIM F1$(20),F2$(20),X(8),Y(8):F1$(1)=
CHR$(172):F1$(20)=CHR$(172):F1$(2)=F1$:F
2$=",,,,,,,,,,,,,,,,,,"
20 RAM=PEEK(106)-16:POKE 756,RAM:IF PEEK
(203)<>200 THEN GOSUB 890:POKE 203,200
30 RESTORE 960:FOR Q=1 TO 8:READ XX,YY:X
(Q)=XX:Y(Q)=YY:NEXT Q:C1=1:C=1
40 GRAPHICS 2
50 ? #6;"     tank battle "
60 ? #6;"    ************"
70 ? :? " ENTER TIME TO PLAY ";:INPUT TI
80 REM
90 GRAPHICS 17:POKE 756,RAM:F1=14:F2=14:
X=5:Y=14:Q=15:W=5:FF1=1:FF2=1
100 S=STICK(0):IF S=7 THEN C=C+1:IF C>8
THEN C=1
110 IF S=11 THEN C=C-1:IF C<1 THEN C=8
```

```
120 IF S=14 THEN COLOR 32:PLOT X,Y:X=X+X
(C):Y=Y+Y(C):SOUND 0,200,8,8
130 IF S<>14 THEN SOUND 0,0,0,0
140 IF X<2 OR X>18 THEN X=X+-X(C):X=(X=2
)%18+(X=18)%2
150 IF Y<2 OR Y>18 THEN Y=Y+-Y(C):Y=(Y=2
)%18+(Y=18)%2
160 COLOR C:PLOT X,Y
170 IF STRIG(0)=0 AND FF1=1 THEN GOSUB 3
40
180 IF STRIG(1)=0 AND FF2=1 THEN GOSUB 5
20
190 S=STICK(1):IF S=7 THEN C1=C1+1:IF C1
>8 THEN C1=1
200 IF S=11 THEN C1=C1-1:IF C1<2 THEN C1
=8
210 IF S=14 THEN COLOR 32:PLOT Q,W:Q=Q+X
(C1):W=W+Y(C1):SOUND 1,100,8,8
220 IF S<>14 THEN SOUND 1,0,0,0
230 IF Q<2 OR Q>18 THEN Q=Q+-X(C1):Q=(Q=
2)%18+(Q=18)%2
240 IF W<2 OR W>18 THEN W=W+-Y(C1):W=(W=
18)%2+(W=2)%18
250 COLOR C1:PLOT Q,W
260 IF F1<1 THEN POSITION 0,21:? #6;"out
 of shots":FF1=0:GOTO 280
270 POSITION 0,21:? #6;"shots1";F1$(1,F1
);" "
280 IF F2<1 THEN POSITION 0,22:? #6;"out
 of shots":FF2=0:GOTO 300
290 POSITION 0,22:? #6;"shots2";F2$(1,F2
);" "
300 POSITION 5,0:? #6;S1:POSITION 15,0:?
 #6;S2:POSITION 8,0:? #6;"TIME":POSITION
 9,1:? #6;INT(TI);" "
310 IF PEEK(53279)=6 THEN GOTO 90
320 TI=TI-0.1:IF TI<0.1 THEN 800
330 GOTO 100
340 X1=X+X(C):Y1=Y+Y(C)
350 IF C=1 OR C=5 THEN FC=10
360 IF C=3 OR C=7 THEN FC=12
370 IF C=2 OR C=6 THEN FC=11
```

```
380 IF C=4 OR C=8 THEN FC=13
390 FOR F=1 TO 5:LOCATE X1,Y1,XX:COLOR F
C:PLOT X1,Y1
400 IF XX<>32 AND XX<10 THEN GOSUB 700:S
1=S1+1:HH=1:GOTO 450
410 SOUND 0,255-F%50,8,15:SOUND 1,150-F%
30,8,155
420 IF X1>18 OR X1<1 THEN 450
430 IF Y1>18 OR Y1<1 THEN 450
440 X1=X1+X(C):Y1=Y1+Y(C):NEXT F
450 X1=X+X(C):Y1=Y+Y(C)
460 FOR E=1 TO 5:COLOR 32:PLOT X1,Y1
470 IF X1>18 OR X1<1 THEN 500
480 IF Y1>19 OR Y1<1 THEN 500
490 X1=X1+X(C):Y1=Y1+Y(C):NEXT E
500 SOUND 0,0,0,0:SOUND 1,0,0,0:F1=F1-1:
IF HH=1 THEN HH=0:GOTO 90
510 RETURN
520 X2=Q+X(C1):Y2=W+Y(C1)
530 IF C1=1 OR C1=5 THEN FC=10
540 IF C1=3 OR C1=7 THEN FC=12
550 IF C1=2 OR C1=6 THEN FC=11
560 IF C1=4 OR C1=8 THEN FC=13
570 FOR F=1 TO 5:LOCATE X2,Y2,XX:COLOR F
C:PLOT X2,Y2
580 SOUND 0,255-F%50,8,15:SOUND 1,150-F%
30,8,15
590 IF XX<>32 AND XX<10 THEN GOSUB 750:S
2=S2+1:HH=1:GOTO 630
600 IF X2>18 OR X2<1 THEN 630
610 IF Y2>18 OR Y2<1 THEN 630
620 X2=X2+X(C1):Y2=Y2+Y(C1):NEXT F
630 X2=Q+X(C1):Y2=W+Y(C1)
640 FOR E=1 TO 5:COLOR 32:PLOT X2,Y2
650 IF X2>18 OR X2<1 THEN 680
660 IF Y2>19 OR Y2<1 THEN 680
670 X2=X2+X(C1):Y2=Y2+Y(C1):NEXT E
680 SOUND 0,0,0,0:SOUND 1,0,0,0:F2=F2-1:
IF HH=1 THEN HH=0:GOTO 90
690 RETURN
700 FOR G=15 TO 0 STEP -3
```

```
710 FOR H=0 TO 2
720 SOUND H,RND(1)*50+100,8,G
730 NEXT H
740 NEXT G:FOR G=0 TO 2:SOUND G,0,0,0:NE
XT G:RETURN
750 FOR G=15 TO 0 STEP -3
760 FOR H=0 TO 2
770 SOUND H,RND(1)*50+100,8,G
780 NEXT H
790 NEXT G:FOR G=0 TO 2:SOUND G,0,0,0:NE
XT G:RETURN
800 POSITION 5,10:? #6;"GAME OVER"
810 S1=0:S2=0:FOR Q=1 TO 5
820 SOUND 0,100+C,10,15:SOUND 1,120+C,10
,15:SOUND 2,90+C,10,15
830 C=C-1:IF C=-30 THEN 850
840 GOTO 820
850 C=0:NEXT Q
860 FOR Q=0 TO 2:SOUND Q,0,0,0:NEXT Q
870 IF PEEK(53279)=6 THEN RUN
880 POKE 53279,0:GOTO 870
890 FOR Q=0 TO 1024:A=PEEK(57344+Q):POKE
 RAM*256+Q,A:NEXT Q:C=8
900 READ A:IF A=-1 THEN RETURN
910 POKE RAM*256+C,A:C=C+1:GOTO 900
920 DATA 24,24,219,219,255,255,255,219,2
5,50,100,249,187,62,12,24,254,254,48,127
,127,48,254,254
925 DATA 24,12,62,187,249,100,50,25
930 DATA 219,255,255,255,219,219,24,24,2
4,50,124,221,159,38,76,152
935 DATA 127,127,12,254,254,12,127,127,1
52,76,38,159,221,124,50,24
940 DATA 112,120,248,254,255,127,60,56,2
4,24,24,24,24,24,24,24,1,2,4,8,16,32,64,
128,0,0,0,255,255,0,0,0
950 DATA 128,64,32,16,8,4,2,1,-1
960 DATA 0,-1,1,-1,1,0,1,1,0,1,-1,1,-1,0
,-1,-1
```

DIGIT DODGE

(Keyboard)

Use the keys "Z" and "X" to move your number cruncher. Press "." to shoot and crunch any numbers the same as those shown on the number cruncher. Destroying a mystery points character ("*") adds a bonus to your score. When the invading numbers reach your digit dodger, the game is over.

```
0 GOTO 135:REM ** DIGIT DODGE BY P.BUNN
1 FOR I=50 TO 75 STEP 2:SOUND 0,I,10,15:
NEXT I:I=0:Y=M+48:IF M=10 THEN Y=10
2 Q$=CHR$(Y):IF A$(1,1)=Q$ THEN I=1:S=S+
10
3 IF A$(2,2)=Q$ AND I=0 THEN A$(2,2)=A$(
1,1):I=1:S=S+20
4 IF A$(3,3)=Q$ AND I=0 THEN A$(3,3)=A$(
2,2):A$(2,2)=A$(1,1):I=1:S=S+30
5 IF A$(4,4)=Q$ AND I=0 THEN A$(4,4)=A$(
3,3):A$(3,3)=A$(2,2):A$(2,2)=A$(1,1):I=1
:S=S+40
6 IF A$(5,5)=Q$ AND I=0 THEN A$(5,5)=A$(
4,4):A$(4,4)=A$(3,3):A$(3,3)=A$(2,2):I=1
:S=S+50
7 IF A$(6,6)=Q$ AND I=0 THEN A$(6,6)=A$(
5,5):A$(5,5)=A$(4,4):A$(4,4)=A$(3,3):A$(
3,3)=A$(2,2):I=1:S=S+60
8 IF I=1 THEN A$(1,1)=" ":N=N+1
10 IF I=1 AND Q$=CHR$(10) THEN FOR I=255
 TO 20 STEP -18:SOUND 0,I,10,15:NEXT I:S
=S+(INT(RND(0)*7+3)*100)
11 POSITION 1,0:? #6;SC$;S:? #6;"  high:
";HS
12 SOUND 0,0,0,0:RETURN
20 FOR I=14 TO 0 STEP -2:SOUND 0,M+15*30
,10,I:NEXT I:RETURN
135 DIM A$(6),Q$(1),SC$(6):GOSUB 2000
140 GRAPHICS 2:SETCOLOR 4,2,2:SETCOLOR 2
```

```
,2,4
150 A$="      ":A$(6,6)=CHR$(RND(0)*9+48)
160 S=0:N=5:M=0:U=18:GOSUB 11
165 Y=M+48:IF M=10 THEN Y=10
170 POSITION 5,5:? #6;CHR$(Y);":";A$
180 I=PEEK(764):I2=PEEK(53775)
190 IF I=22 AND I2=251 THEN M=M+1:GOSUB
20:IF M>10 THEN M=0
200 IF I=23 AND I2=251 THEN M=M-1:GOSUB
20:IF M<0 THEN M=10
210 IF I=34 AND I2=251 THEN GOSUB 1
215 I=0
220 TRAP 1000:O=O+1:IF O/U=INT(O/U) THEN
 A$(N,N)=CHR$(RND(0)*10+48):I=1
222 IF I=1 THEN IF A$(N,N)=CHR$(58) THEN
 A$(N,N)=CHR$(10)
224 IF I=1 THEN N=N-1:I=0
225 IF INT(RND(0)*20)=3 THEN U=U-1:IF U<
8 THEN U=8
230 TRAP 40000:GOTO 165
1000 ? #6:? #6;"..invaded..":FOR I=90 TO
 220 STEP 11:FOR H=80 TO 90 STEP 2:SOUND
 0,H,10,15:SOUND 1,I,10,15
1010 SETCOLOR 4,H,4
1020 POKE 709,INT(RND(0)*15)*16+8
1030 NEXT H:NEXT I:SETCOLOR 4,2,4:POKE 7
64,255
1040 SOUND 0,0,0,0:SOUND 1,0,0,0:IF S>HS
 THEN HS=S:POSITION 0,2:? #6;"high score
!!!!"
1050 ? "ANOTHER TRY ";:TRAP 1050:INPUT A
$
1055 IF A$(1,1)="N" THEN GRAPHICS 0:? "G
OODBYE.":? :? :END
1060 IF A$(1,1)="Y" THEN 140
1070 GOTO 1050
2000 FOR P=1 TO 6
2010 READ N
2020 SC$(P,P)=CHR$(N)
2030 NEXT P
2040 DATA 243,227,239,242,229,186
2050 RETURN
```

GRAND PRIX 2

(Joystick)

Use the joystick to control the car as it speeds down the track. If you manage to reach the finish you win a bonus and step value is doubled for your next run.

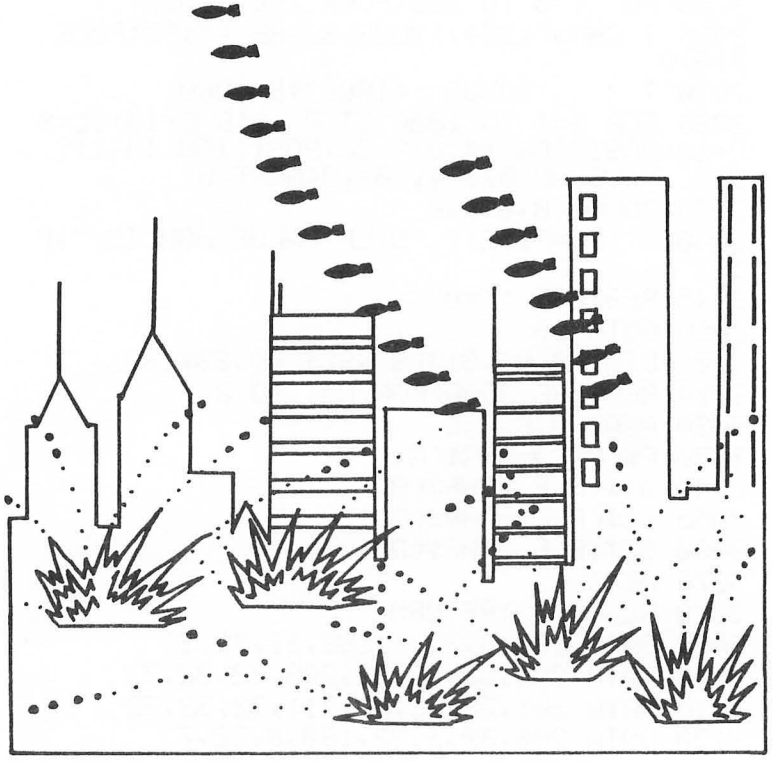
```
10 REM ** GRAND PRIX 2 - P.BUNN **
15 PI=5:GOSUB 3000:CRASH=1000
20 X2=14:X=116:S=PEEK(106)-8:Q=S*256:FOR
 N=Q+512 TO Q+640:POKE N,0:NEXT N:POKE 5
4279,S
30 POKE 559,46:POKE 53248,X:POKE 704,216
:POKE 704,70:POKE 53256,1
40 FOR N=Q+552 TO Q+561:READ A:POKE N,A:
NEXT N
50 DATA 129,195,165,24,24,153,219,165,36
,24
60 GRAPHICS 0:SETCOLOR 2,0,0:POKE 53277,
3:POKE 559,46
65 POKE 752,1:POKE 53278,A
66 FOR P=0 TO 23:POKE 201,X2:? ,S2$:NEXT
 P
70 S=STICK(0):X=X+(S=7)*2:X=X-(S=11)*2:P
OKE 53248,X
72 SOUND 0,40,10,15:SC=SC+PI:SOUND 0,0,0
,0
75 IF O THEN O=0:Z=2:GOTO 110
80 A=PEEK(53770)
90 IF A>85 AND A<170 THEN Z=2
100 IF A>170 AND X2<15 THEN Z=3:O=1
105 IF A<85 AND X2>2 THEN X2=X2-1:Z=1:O=
1
110 POKE 201,X2
115 IF A=192 AND  NOT I THEN ? ,F$:I=1:G
OTO 145
120 IF Z=1 THEN ? ,S1$
```

```
130 IF Z=2 THEN ? ,S2$
140 IF Z=3 THEN ? ,S3$:X2=X2+1
145 Y=PEEK(53252):IF Y<>0 AND I THEN GOT
O 2000
150 IF Y<>0 THEN GOTO CRASH
160 GOTO 70
1000 REM ** YOU CRASHED! **
1010 N=INT(RND(0)*10):POKE 0+552+N,PEEK(
53770):SOUND 0,RND(0)*20+20,80,15:POKE 7
04,PEEK(53770)
1020 IF PEEK(53770)<240 THEN 1010
1030 POKE 53248,0:? :? "YOU SCORED:";SC:
? :? :? "HIT ANY KEY.":POKE 764,255
1035 SOUND 0,0,0,0
1040 IF PEEK(764)=255 THEN 1040
1050 RUN
2000 FOR Y=0 TO 255:POKE 710,Y:NEXT Y
2005 ? CHR$(125);"YOUR SCORE :";SC:POKE
710,0
2010 ? "    BONUS  :1000":B=1000
2020 FOR G=1 TO 1000 STEP 10:B=B-10:SC=S
C+10:POSITION 14,0:? SC:POSITION 14,1:?
B;"  ":SOUND 0,G/4,10,10:NEXT G
2030 SOUND 0,0,0,0
2040 ? :PI=PI*2:? "STEP VALUE NOW IS ";P
I
2045 RESTORE :I=0
2050 GOTO 20
3000 DIM F$(8),S1$(8),S2$(8),S3$(8)
3010 RESTORE 3000:FOR P=1 TO 8
3020 READ A,B,C,D
3030 F$(P,P)=CHR$(A)
3040 S1$(P,P)=CHR$(B)
3050 S2$(P,P)=CHR$(C)
3060 S3$(P,P)=CHR$(D)
3070 NEXT P
3080 RESTORE :RETURN
3090 DATA 160,6,22,7,198,32,32,32
3100 DATA 201,32,32,32,206,32,32,32
3110 DATA 201,32,32,32,211,32,32,32
3120 DATA 200,32,2,32,160,6,32,7
```

CITY BOMB

(Joystick)

Your plane has developed engine failure and is slowly descending on a city below. By bombing the city, and killing millions of people, you will be able to land safely—otherwise you will crash! Press the joystick button each time you want a bomb to drop.



```
10 REM ******************************
20 REM ** CITY BOMB   VERSION II  **
30 REM **  WRITTEN BY PAUL BUNN   **
40 REM **       JANUARY 1983       **
50 REM ******************************
60 REM
65 IF PEEK(203)=PEEK(106)-8 THEN 80
70 GOSUB 10000:REM % INITIALIZATION %
80 GRAPHICS 0:SETCOLOR 2,8,0:SETCOLOR 4,
8,0
90 OPEN #1,4,0,"K:":POKE 752,1
100 ? "WHAT SKILL LEVEL (1-9)"
110 GET #1,A:A=A-48
120 IF A<1 OR A>9 THEN 110
130 A=A+3
135 POKE 756,PEEK(203)
140 ? CHR$(125):FOR I=1 TO 38
150 Y=INT(RND(0)*A)+1
160 FOR P=22 TO 22-Y STEP -1
170 POSITION I,P:? "$":REM %CITY CHARACT
ER %
180 NEXT P
190 FOR P=15 TO 0 STEP -1
200 SOUND 0,I*6+20,10,P
210 NEXT P
220 NEXT I
230 COLOR 94
240 PLOT 1,23:DRAWTO 39,23
250 X=1:Y=0:BM=0:SC=0
260 POSITION X,Y:OX=X:OY=Y
270 PRINT "%";:REM %PLANE CHARACTER%
280 X=X+1
290 IF X=39 THEN X=1:Y=Y+1
300 IF X>25 AND Y=22 THEN 1000:REM %MADE
 IT!%
310 LOCATE X,Y,Z
320 POSITION OX,OY:? " "
330 IF Z=ASC("$") THEN 2000:REM %CRASH%
340 IF STRIG(0)=0 AND BM=0 THEN GOSUB 30
00:REM % BUTTON ROUTINE %
350 IF BM=1 THEN GOSUB 4000:REM % MOVE B
```

```
OMB ROUTINE %
360 GOTO 260
1000 POSITION 13,10:? "LANDED !"
1010 POSITION 13,11:? "%%%%%%%%"
1020 FOR T=0 TO 6000 STEP 20
1030 SOUND 0,T,10,15:NEXT T
1035 SOUND 0,0,0,0
1040 ? CHR$(125);"WELL DONE , YOUR SCORE
 WAS ";SC
1050 END
2000 POSITION X-1,Y-1
2010 ? CHR$(7);CHR$(124);CHR$(6)
2020 POSITION X-1,Y
2030 ? "-%-"
2040 POSITION X-1,Y+1
2050 ? CHR$(6);CHR$(124);CHR$(7)
2060 FOR P=200 TO 10 STEP -10
2070 FOR I=P-5 TO P+5
2080 SOUND 0,I,120,15
2090 NEXT I
2100 C=INT(RND(0)%15)
2110 SETCOLOR 2,C,2:SETCOLOR 4,C,2
2120 NEXT P
2130 SOUND 0,0,0,0
2140 POSITION 6,10:? "Another try ?"
2150 GET #1,A
2160 IF CHR$(A)="Y" THEN RUN
2170 IF CHR$(A)<>"N" THEN 2150
2180 GRAPHICS 0:END
3000 BM=1:BX=X:BY=Y+1:K=0:RETURN
4000 POSITION BX,BY:? " "
4010 BY=BY+1:LOCATE BX,BY,Z
4020 POSITION BX,BY
4030 ? CHR$(39):REM %BOMB CHARACTER%
4040 IF Z=ASC("$") THEN 5000
4050 IF BY=22 THEN POSITION BX,22:? " ":
BM=0
4060 RETURN
5000 POSITION BX,BY:? "&":SOUND 0,230,12
0,15:SC=SC+50
5010 POSITION 2,0:? "SCORE:";SC
```

```
5020 K=K+1:IF K=5 THEN BM=0:POSITION BX,
BY:? " "
5030 POSITION BX,BY:? " "
5040 SOUND 0,0,0,0:GOTO 4050
10000 GRAPHICS 0
10010 SETCOLOR 4,9,0:SETCOLOR 2,9,0
10012 ? "CITY BOMB - PLEASE WAIT"
10014 ? "**********************"
10016 POKE 752,1:PRINT
10020 R=PEEK(106)-8
10030 FOR P=0 TO 1023
10040 POKE R*256+P,PEEK(57344+P)
10050 NEXT P
10060 READ I
10070 IF I<0 THEN POKE 203,R:RETURN
10080 FOR P=0 TO 7
10090 READ K
10100 POKE R*256+(8*I)+P,K
10110 NEXT P
10120 GOTO 10060
10130 DATA 4,255,129,129,129,129,129,129
,255
10140 DATA 5,16,8,132,194,255,2,4,8
10150 DATA 6,170,85,170,85,170,85,170,85
10160 DATA 7,0,36,60,24,24,60,24,0
10170 DATA -99
```

ENGULF

(Keyboard)

In control of the space-cruiser Battlestar, you must engulf an alien by destroying all the sectors of space around it. Neither you nor the alien (shown as a letter A) can move onto the outer border of the area of space under view (these forbidden areas are shown as "-"). The alien moves one, two or no spaces in any move, and you enter your move as two co-ordinates, pressing RETURN after each one. Any area you blast appears as a blank in the area otherwise shown as asterisks. You engulf the alien by totally destroying all the squares onto which it could move. You are not allowed to land on the alien, and will destroy yourself if you do so.

The alien keeps a watch on the space around it, and signals to your computer the degree of danger it senses, so you know, more or less, what the alien is thinking.

The best strategy is to get the alien trapped against one of the sides, as it limits the alien's possible moves. The alien is aware of this and, using the "intelligence" in lines 6145 and 6161, will tend to move away from the sides, to minimize the chance of being trapped. Knowing this, you may be well-advised to build a "fence" of blank areas in a curve around the alien, trying to hold it into the sides, or force it to move to the sides.

There is a highest score feature.

```
1 GRAPHICS 0:SETCOLOR 4,8,0:SETCOLOR 2,8
,0
3 DIM A(10,10)
5 HISCORE=0
10 REM ENGULF
20 REM (C)HARTNELL 1982
30 GOSUB 9000:REM INITIALISE
40 GOSUB 8000:REM PRINT OUT
```

```
50 GOSUB 7000:REM ACCEPT PLAYER DECISION
60 GOSUB 6000:REM UPDATE ALIEN
70 TIME=TIME-1
75 SHOTS=SHOTS+1
80 IF TIME=0 THEN 6570
85 GOSUB 8000
90 GOTO 50
910 TIME=30
5000 REM COLLISION
5010 PRINT "YOU HIT THE ALIEN,CAPTAIN"
5020 PRINT "AND HAVE BEEN DESTROYED"
5030 GOTO 6570
6000 REM UPDATE ALIEN
6010 REM CHECK IF SURROUNDED
6020 H=0
6030 IF A(M-1,N)=2 THEN H=H+1
6040 IF A(M-1,N-1)=2 THEN H=H+1
6050 IF A(M,N-1)=2 THEN H=H+1
6060 IF A(M,N+1)=2 THEN H=H+1
6070 IF A(M-1,N+1)=2 THEN H=H+1
6080 IF A(M+1,N+1)=2 THEN H=H+1
6090 IF A(M+1,N-1)=2 THEN H=H+1
6100 IF A(M+1,N)=2 THEN H=H+1
6110 IF H=8 THEN 6500:REM SURROUNDED
6120 REM MOVE ALIEN
6125 E=M:F=N
6130 M=M-INT(RND(1)%2)+INT(RND(1)%2)
6140 IF M<2 OR M>9 THEN 6130
6145 IF (M<4 OR M>7) AND RND(1)>0.7 THEN
 6130
6150 N=N-INT(RND(1)%2)+INT(RND(1)%2)
6160 IF N<2 OR N>9 THEN 6150
6161 IF (N<4 OR N>7) AND RND(1)>0.7 THEN
 6150
6162 IF A(M,N)=2 THEN 6130
6165 A(E,F)=0
6170 A(M,N)=1
6300 RETURN
6500 REM SURROUND
6505 GOSUB 8000
```

```
6510 PRINT "ENGULFED! WELL DONE"
6520 PRINT "IT TOOK YOU ";SHOTS;" SHOTS"
6530 PRINT "AND YOU DID IT WITH ";TIME;"
 TIME UNITS","LEFT"
6540 Q=TIME%125.67
6550 PRINT "YOUR RATING IS ";Q
6560 IF Q>HISCORE THEN HISCORE=Q
6570 PRINT "HIGHEST SCORE SO FAR IS ";HI
SCORE
6580 PRINT
6590 PRINT "ENTER 1 FOR ANOTHER GAME,2 T
O END"
6600 INPUT A
6610 IF A=1 THEN 10
6620 PRINT "OVER AND OUT,CAPTAIN"
6630 END
7000 REM ACCEPT PLAYER DECISION
7010 PRINT "WHICH SECTOR WILL YOU SHOOT
AT"
7020 PRINT "ACROSS";
7030 TRAP 7030:INPUT S:TRAP 40000
7035 IF S<2 OR S>9 THEN 7030
7040 PRINT S;" AND DOWN";
7050 TRAP 7050:INPUT R:TRAP 40000
7055 IF R<2 OR R>9 THEN 7050
7060 IF A(R,S)=1 THEN 5000:REM HIT ALIEN
,END OF GAME
7070 IF A(R,S)=2 THEN PRINT "SECTOR ALRE
ADY DESTROYED":FOR P=200 TO 255:SOUND 0,
P,10,15:NEXT P:SOUND 0,0,0,0
7090 IF A(R,S)=2 THEN RETURN
7100 A(R,S)=2
7110 RETURN
8000 REM PRINT OUT
8005 PRINT CHR$(125)
8020 PRINT
8030 PRINT "----ALIEN SENSES DANGER OF F
ACTOR-";H;"---"
8050 PRINT "BATTLESTAR COMPUTER REPORTS:
",,"HIGHEST SCORE IS ";HISCORE
8060 PRINT "-----------------------------
---------"
```

```
8080 PRINT
8090 PRINT "   ALIEN NOW AT ";N;" ";M
8100 PRINT
8110 PRINT "TIME LEFT: ";TIME,"SHOTS FIR
ED: ";SHOTS
8120 PRINT
8125 PRINT "12345678910"
8130 FOR K=1 TO 10
8140 FOR J=1 TO 10
8145 IF K<2 OR K>9 OR J<2 OR J>9 THEN PR
INT "-";
8146 IF K<2 OR K>9 OR J<2 OR J>9 THEN 81
80
8150 IF A(K,J)=0 THEN PRINT "%";:SOUND 0
,K%8+J%4,10,15
8160 IF A(K,J)=1 THEN PRINT "A";:FOR P=2
0 TO 0 STEP -1:SOUND 0,P,12,15:NEXT P
8170 IF A(K,J)=2 THEN PRINT " ";:FOR P=4
0 TO 0 STEP -2:SOUND 0,P,8,15:NEXT P
8180 SOUND 0,0,0,0:NEXT J
8190 PRINT K
8200 NEXT K
8210 PRINT
8990 RETURN
9000 REM INITIALISE
9010 TIME=30
9020 SHOTS=0
9030 H=0
9050 FOR B=1 TO 10
9055 FOR C=1 TO 10
9060 A(B,C)=0
9065 IF B<2 OR B>9 OR C<2 OR C>9 THEN A(
B,C)=2
9067 NEXT C
9070 NEXT B
9080 M=INT(RND(1)%7)+2
9090 N=INT(RND(1)%7)+2
9100 A(M,N)=1
9900 RETURN
```

COLOR PATTERN

This short program produces a pattern in graphics Mode 10 and then gives a hypnotizing effect by rotating the colors.

```
10 GRAPHICS 10
20 POKE 704,0
30 POKE 705,12
40 POKE 706,3*16+4
50 POKE 707,12
55 POKE 708,12
60 FOR X=0 TO 79
70 C=C+1:IF C=5 THEN C=1
80 COLOR C
90 PLOT X,X
100 DRAWTO 79-X,X
110 DRAWTO 79-X,191-X
120 DRAWTO X,191-X
130 DRAWTO X,X
140 NEXT X
145 REM ** ROTATE COLOURS **
150 A=PEEK(705)
160 POKE 705,PEEK(706)
170 POKE 706,PEEK(707)
185 POKE 707,PEEK(708)
186 POKE 708,A
190 A=SIN(A):REM ** DELAY **
200 GOTO 150
```

COLOR PUZZLE

(Keyboard)

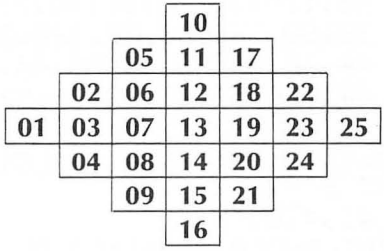
This marvelous puzzle should prove challenging to solve. Here are the rules.

The first four moves must be placed in the four corners (01,10,16 and 25).

To place a color square on the grid, it must be next to another square horizontally or vertically, *not* diagonally. A color square must not be placed next to another color square of the same color in the eight squares around it.

Proceed to place color squares in this fashion until all 25 spaces are filled.

The squares are numbered as follows:



Note that a zero is required before a single digit, and that RETURN does not have to be pressed. If an illegal move is attempted the computer will bleep. When you cannot move, just type "99".

```
10 REM ** COLOUR PUZZLE -        **
20 REM **          BY PAUL BUNN   **
25 REM ********************************
30 GRAPHICS 10
40 POKE 704,12
50 POKE 705,3*16+4
60 POKE 706,12*16+6
70 POKE 707,7*16+2
80 POKE 708,15*16+4
90 POKE 709,0:POKE 710,15*16+10
100 COLOR 6:POKE 703,4
110 FOR X=0 TO 48 STEP 8
120 READ Y
130 FOR X2=0 TO 7
140 PLOT X+X2+12,90-Y
150 DRAWTO X+X2+12,90+Y
160 NEXT X2
170 NEXT X
180 DATA 10,30,50,70,50,30,10
190 DIM X(25),Y(25)
200 FOR X2=1 TO 25
210 READ X,Y:X(X2)=X:Y(X2)=Y
220 NEXT X2
230 DATA 12,80,20,60,20,80,20,100
240 DATA 28,40,28,60,28,80,28,100
250 DATA 28,120,36,20,36,40,36,60
260 DATA 36,80,36,100,36,120,36,140
270 DATA 44,40,44,60,44,80,44,100
280 DATA 44,120,52,60,52,80,52,100
290 DATA 60,80
300 FOR P=1 TO 25:COLOR 5:PLOT X(P)+3,Y(
P)+10:NEXT P
310 OPEN #1,4,0,"K:"
311 COL=INT(RND(0)*5)+1:COLOR COL
312 B=B+(COL=3):R=R+(COL=1):G=G+(COL=2):
YL=YL+(COL=4):BL=BL+(COL=5)
313 IF COL=1 AND R>5 THEN R=5:GOTO 311
314 IF COL=2 AND G>5 THEN G=5:GOTO 311
315 IF COL=3 AND B>5 THEN B=5:GOTO 311
316 IF COL=4 AND YL>5 THEN YL=5:GOTO 311
```

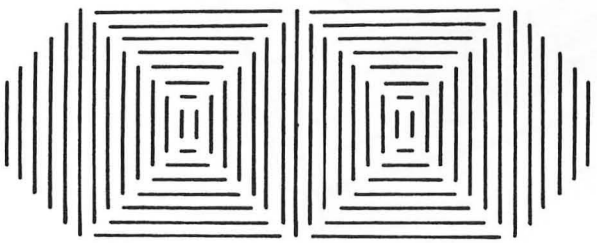
```
317 IF COL=5 AND BL>5 THEN BL=5:GOTO 311
319 FOR P=0 TO 10:PLOT P,0:DRAWTO P,20:N
EXT P
320 GET #1,KEY:KEY=KEY-48:KEY=KEY%10
325 GET #1,KEY2:KEY=KEY+KEY2-48
326 IF KEY=99 THEN 2000
327 IF KEY<1 OR KEY>25 THEN PRINT CHR$(2
53):GOTO 320
330 LOCATE X(KEY),Y(KEY),C
340 IF C<>6 THEN PRINT CHR$(253):GOTO 32
0
350 IF KEY<>1 AND KEY<>10 AND KEY<>16 AN
D KEY<>25 AND K<4 THEN PRINT CHR$(253):G
OTO 320
355 IF J=1 THEN K=5
360 IF KEY=1 OR KEY=10 OR KEY=16 OR KEY=
25 THEN K=K+1:IF K=4 THEN J=1
370 X=X(KEY)+3:Y=Y(KEY)+10
380 LOCATE X-6,Y,C1
390 LOCATE X-6,Y-17,C2
400 LOCATE X,Y-17,C3
410 LOCATE X+6,Y-17,C4
420 LOCATE X+6,Y,C5
430 LOCATE X+6,Y+17,C6
440 LOCATE X,Y+17,C7
450 LOCATE X-6,Y+17,C8
460 IF C1=COL OR C2=COL OR C3=COL OR C4=
COL OR C5=COL OR C6=COL OR C7=COL OR C8=
COL THEN ? CHR$(253):GOTO 320
470 U=(C1=6)+(C3=6)+(C5=6)+(C7=6)
473 I=(C1=0)+(C3=0)+(C5=0)+(C7=0)
475 IF U+I=4 AND K>4 THEN PRINT CHR$(253
):GOTO 320
480 COLOR COL
485 X=X(KEY):Y=Y(KEY)
490 FOR P=0 TO 7
500 PLOT X+P,Y
510 DRAWTO X+P,Y+19
520 NEXT P
525 IF R+G+B+YL+BL=25 THEN 1000
530 NO=NO+1:GOTO 311
```

```
1000 FOR G=205 TO 5 STEP -5
1010 FOR P=G-3 TO G+3
1020 SOUND 0,P,10,15
1030 NEXT P
1040 POKE 704,(INT(RND(0)*15)*16)+8
1050 NEXT G
1060 GRAPHICS 0:SETCOLOR 2,9,2:SETCOLOR
4,9,2
1070 POSITION 4,12
1080 ? "WELL DONE YOU SOLVED THE PUZZLE"
1090 POSITION 4,13
1100 POKE 752,1
1110 ? "**********************************"
1130 FOR P=0 TO 255
1140 SOUND 0,P,10,15
1150 NEXT P
1160 SOUND 0,0,0,0
1170 END
2000 FOR G=0 TO 256
2010 SOUND 0,G,10,15
2020 POKE 704,G/2
2030 NEXT G
2040 SOUND 0,0,0,0:POKE 704,12
2050 GRAPHICS 0:POKE 752,1
2055 POSITION 10,12:POKE 710,3*16+4
2060 ? "BAD LUCK - TRY AGAIN"
2065 POSITION 10,13
2070 ? "********************"
2080 FOR P=0 TO 2000 STEP 20
2090 SOUND 0,P,10,15:NEXT P
2100 SOUND 0,0,0,0
2110 ? :?
2120 ? "YOU HAD ";25-NO;" LEFT TO FILL"
2130 END
```

STRING PATTERN

This short, simple program produces lovely patterns and sounds.

```
10 REM ** STRING PATTERN WRITTEN **
20 REM **    BY PAUL BUNN 1983   **
30 REM ****************************
40 GRAPHICS 8+16:SETCOLOR 2,0,0
45 COLOR 1:SETCOLOR 1,0,14
50 FOR X=0 TO 191 STEP 10
60 PLOT 64,191-X
70 DRAWTO X+64,0
80 PLOT 191-X+64,0
90 DRAWTO 191+64,191-X
100 PLOT 64,X
110 DRAWTO X+64,191
120 PLOT 191+64,X
130 DRAWTO 191-X+64,191
140 NEXT X
145 FOR P=0 TO 14 STEP 0.2
150 SETCOLOR 1,0,P
155 SOUND 0,P%40,10,15
160 NEXT P:GOTO 145
```

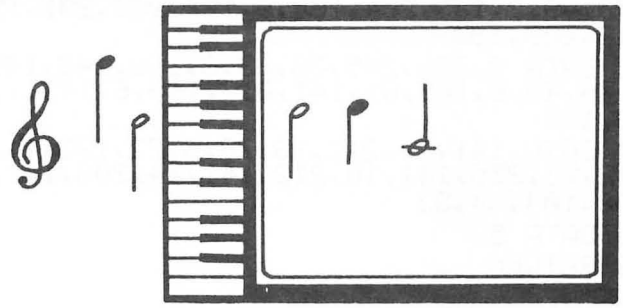


SOUND PROGRAM

(Keyboard)

This short and interesting program will produce piano-like sounds, remember notes and then play them back when you press the "ESC" key.

```
10 REM %%  SOUND PROGRAM  %%
20 REM %%        BY       %%
30 REM %%    PAUL BUNN    %%
40 REM %%%%%%%%%%%%%%%%%%%%
50 GRAPHICS 0
60 SETCOLOR 2,8,0:SETCOLOR 4,8,0
70 TRAP 160
90 DIM T(500)
100 OPEN #1,4,0,"K:"
105 ? CHR$(125):? "PRESS KEYS TO GET DIF
FERENT"
106 ? "NOTES.TO HEAR PLAYED BACK PRESS
ESC'"
110 GET #1,A:L=L+1
115 IF A=27 THEN 160
120 T(L)=A
130 FOR X=15 TO 0 STEP -1
140 SOUND 0,A,10,X:NEXT X
150 GOTO 110
160 ? CHR$(125)
170 ? "WHAT TEMPO (1-4)"
180 GET #1,A
190 A=A-48:IF A<1 OR A>4 THEN 180
200 FOR J=1 TO L
210 S=T(J)
220 FOR X=15 TO 0 STEP -1
230 SOUND 0,S,10,X:NEXT X
235 FOR G=1 TO 10*(A-1):NEXT G
240 NEXT J
250 END
```



DISPLAY LIST INTERRUPT EXAMPLE

This program demonstrates just a little of what a DLI can do. I suggest you SAVE the program before attempting to RUN it, since it is written entirely in machine code.

```
10 REM ******************************
20 REM ** Display List Interrupt  **
30 REM **         example          **
40 REM **  Written by Paul Bunn    **
50 REM ******************************
60 GOSUB 1000
70 X=USR(1536)
1000 FOR A=1536 TO 1636:READ B:POKE A,B:
NEXT A
1001 DATA 162,16,169,3,157,66,3,169,99,1
57,68,3,169,6,157,69,3,169,12,157,74,3,1
69,8,157
1002 DATA 75,3,32,86,228,173,48,2,133,20
3,173,49,2,133,204,160,0,177,203,201,15,
240,8,200,192
1003 DATA 0,208,245,76,63,6,169,143,145,
203,76,48,6,169,81,141,0,2,169,6,141,1,2
,169,192
1004 DATA 141,14,212,76,78,6,72,173,11,2
12,42,73,255,141,10,212,141,24,208,141,2
6,208,104,64,83
1005 DATA 58
1006 RETURN
```

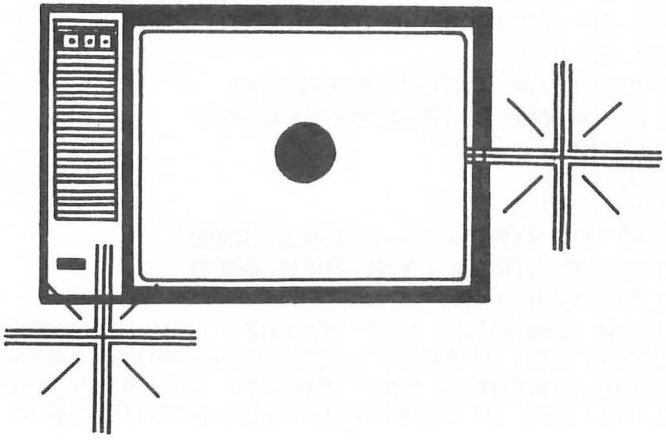
REACTION TIMER

(Two joysticks)

This is a short program for two players and is very simple to play. When you see a dot on the screen press the fire button. The first player to do this wins a point. The first player to get 10 points wins the game. This program tests reflexes.

```
10 REM ** REACTION TIMER            **
20 REM ** BY P.BUNN , NOVEMBER 1981**
30 REM
31 DIM A$(30),B$(30)
32 ? "PLAYER 1'S NAME ";:INPUT A$
33 ? "PLAYER 2'S NAME ";:INPUT B$
40 GRAPHICS 5
45 SETCOLOR 2,3,4
50 A=INT(RND(0)*200)+200
60 FOR L=1 TO A
70 IF STRIG(0)=0 THEN GOTO 1000
80 IF STRIG(1)=0 THEN GOTO 2000
90 NEXT L
100 COLOR INT(RND(0)*3)+1
110 A=RND(0)*79:B=RND(0)*39
120 PLOT A,B
130 A=0
140 A=A+1
150 IF STRIG(0)=0 THEN 3000
160 IF STRIG(1)=0 THEN 4000
170 GOTO 140
1000 GRAPHICS 0:? "CHEAT! YOU PRESSED TH
E BUTTON TO SOON":SC2=SC2+1:GOTO 5000
2000 GRAPHICS 0:? "CHEAT! YOU PRESSED TH
E BUTTON TO SOON":SC1=SC1+1:GOTO 5000
```

```
3000 GRAPHICS 0:? A$;" WINS!....WITH A T
IME OF:-                ";A/100:SC1=SC1+1:IF
 SC1>=10 THEN 6000
3005 GOTO 5000
4000 GRAPHICS 0:? B$;" WINS!....WITH A T
IME OF:-                ";A/100:SC2=SC2+1:I
F SC2>=10 THEN 7000
4005 GOTO 5000
5000 ? :? :? :?
5005 ? "            ======"
5010 ? "            SCORES"
5020 ? "            ======"
5030 PRINT :PRINT
5040 ? A$;"                              ";B$
5050 ? "--------------------------------
-----"
5060 ?
5070 ? SC1;"
";SC2
5080 ? :? :? "PRESS 'FIRE BUTTON' WHEN R
EADY"
5090 IF STRIG(0)<>0 THEN 5090
5100 FOR L=1 TO 100:NEXT L:GOTO 40
6000 ? :? :? :? A$;" WINS THE GAME !!.."
6005 ? :? :END
7000 ? :? :? :? B$;" WINS THE GAME !!.."
7005 ? :? :END
```

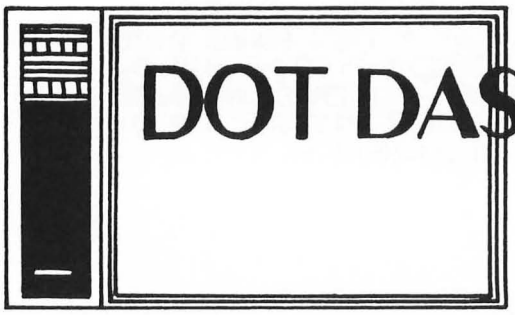


MORSE CODE

Just type any sentence when prompted, and the program will convert it into Morse code; you will hear the Morse code through the television speaker.

```
10 REM ******************************
20 REM * MORSE CODE CONVERTER BY  *
30 REM *     P.BUNN & J.VINCENT     *
40 REM ******************************
50 GRAPHICS 0
60 SETCOLOR 2,8,0:SETCOLOR 4,8,0
70 DL=PEEK(560)+256*PEEK(561)+4
80 POKE DL+2,7:POKE DL+3,7
90 POSITION 0,1
100 ? "MORSE CODE CONVERTER";
110 ? "********************"
120 ? :? :? "TYPE IN MESSAGE YOU WANT TO
 HEAR :-"
130 DIM A$(100),B$(5)
140 SOUND 0,0,0,0:TRAP 140:INPUT A$
150 FOR X=1 TO LEN(A$)
155 IF A$(X,X)=" " THEN FOR P=1 TO 100:N
EXT P:NEXT X
160 Y=ASC(A$(X,X))-65
170 RESTORE Y+1000
180 B$="      ":READ B$
190 FOR Z=1 TO LEN(B$)
200 IF B$(Z,Z)="." THEN SOUND 0,30,10,15
:FOR P=1 TO 20:NEXT P:SOUND 0,0,0,0
210 IF B$(Z,Z)="-" THEN SOUND 0,30,10,15
:FOR P=1 TO 50:NEXT P:SOUND 0,0,0,0
220 FOR P=1 TO 20:NEXT P
230 NEXT Z
240 NEXT X
250 RUN
1000 DATA .-
1001 DATA -...
```

```
1002 DATA -.-.
1003 DATA -..
1004 DATA .
1005 DATA ..-.
1006 DATA --.
1007 DATA ....
1008 DATA ..
1009 DATA .---
1010 DATA -.-
1011 DATA .-..
1012 DATA --
1013 DATA -.
1014 DATA ---
1015 DATA .--.
1016 DATA --.-
1017 DATA .-.
1018 DATA ...
1019 DATA -
1020 DATA ..-
1021 DATA ...-
1022 DATA .--
1023 DATA -..-
1024 DATA -.--
1025 DATA --..
```



COMPLIMENT GENERATOR

Feeling depressed? Just RUN this program, and increase your self-esteem immediately.

```
10 REM ** COMPLIMENT GENERATOR **
20 DIM A$(15),B$(15)
30 A=INT(RND(1)*10)
40 B=INT(RND(1)*7)
50 RESTORE 1000+A
60 READ A$
70 RESTORE 2000+B
80 READ B$
90 ? A$;" ";B$
95 A=INT(RND(0)*16):SETCOLOR 2,A,4:SETCO
LOR 4,A,4
96 FOR F=1 TO 300:NEXT F
100 RUN
1000 DATA BRILLIANT
1001 DATA LOVELY
1002 DATA GREAT
1003 DATA CLEVER
1004 DATA INTELLIGENT
1005 DATA NICE
1006 DATA WISE
1007 DATA BEAUTIFUL
1008 DATA CHARMING
1009 DATA SMART
2000 DATA PERSON
2001 DATA CHARMER
2002 DATA GENIUS
2003 DATA INDIVIDUAL
2004 DATA OPERATOR
2005 DATA HERO
2006 DATA ACE
```

SPACE DOCKER

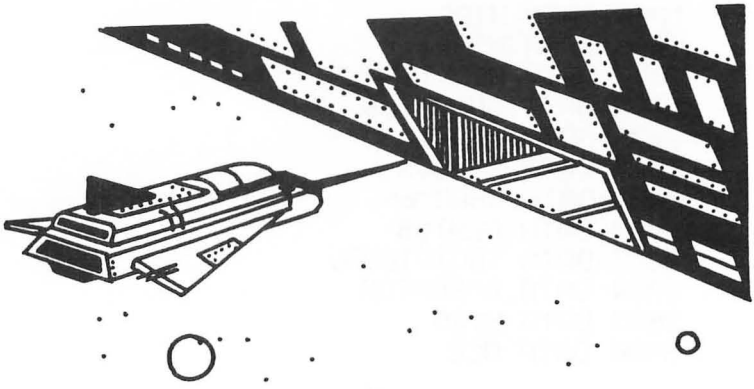
(Joystick)

This is one of the best programs in the book. It uses four players and a machine code routine to move them. No movement is done in BASIC, as it is too slow.

Battling with alien invaders in some distant galaxy, your ship suddenly takes a direct hit. You enter the tiny escape shuttle with your crew, blast off, and race toward the mother ship where safety is assured. Your air supply, however, is rapidly running out: you have only 300 units left. Your mission, using the joystick in Port 1, is to dock with the mother ship before the supply expires completely.

You use the joystick button to thrust, pushing it left or right to steer the shuttle toward the mother ship. When you succeed in docking with the mother ship, the number of air units you have left will be added to your score.

Anyone interested in the machine code routine I have used will find the assembly listing after the BASIC listing.



```
10 REM ******************************
20 REM * SPACE DOCKER BY P.BUNN &  *
30 REM *       JONATHAN VINCENT     *
40 REM ******************************
50 GOSUB 10000:REM ** INITIALIZATION **
60 GOSUB 20000
65 SOUND 0,0,8,15:POKE 53278,R:AIR=300
70 X=USR(1536)
80 IF PEEK(781+R*256)=24 THEN 1000
90 IF PEEK(53254)<>0 OR PEEK(53262)<>0 T
HEN GOTO 2000
100 AIR=AIR-1:IF AIR<>0 THEN 70
110 POSITION 4,6:? "out of air":SC=0
115 POKE 53251,0
120 FOR P=0 TO 4000 STEP 12
130 SOUND 0,P,10,15:NEXT P
140 SOUND 0,0,0,0
150 POSITION 4,6:? "press START"
155 POSITION 4,4:? "score:";SC
160 POKE 53279,0
170 IF PEEK(53279)<>6 THEN 160
180 POSITION 4,6:? "              ":GOSUB 1
0100:GOTO 65
1000 IF PEEK(209)>PEEK(203) AND PEEK(209
)<PEEK(204) THEN 1020
1010 GOTO 2000
1020 POSITION 4,6:? "docked"
1025 POKE 53251,0
1030 FOR P=230 TO 10 STEP -10
1040 FOR X=P-5 TO P+5
1050 SOUND 0,X,10,15
1060 NEXT X
1070 SETCOLOR 1,RND(0)*16,10
1080 NEXT P
1090 SOUND 0,0,0,0
1100 POSITION 21,4:? "remaining air:";AI
R
1110 SC=SC+AIR:GOTO 150
2000 FOR P=781 TO 896:IF PEEK(R*256+P)<>
24 THEN NEXT P
2005 POKE 53251,0
```

```
2010 E=53770:POKE P+256*R+RND(0)*8,PEEK(
E)
2020 SOUND 0,PEEK(E),8,15:POKE 706,PEEK(
E)
2030 S=S+1:IF S<50 THEN 2010
2035 POKE 53250,0:POKE 53251,0
2040 S=0:SC=S:GOTO 140
10000 GRAPHICS 0:DL=PEEK(560)+256*PEEK(5
61)+4:POKE 82,0
10010 POKE DL+5,7:POKE DL+6,6:POKE DL+7,
6:POKE DL+8,6:POKE DL+9,6
10020 SETCOLOR 4,9,4:SETCOLOR 1,3,4:POKE
 DL+10,6
10030 SETCOLOR 0,3,8:SETCOLOR 1,13,10
10040 POSITION 0,4:POKE 752,1
10050 ? "     SPACE DOCKER     ";
10055 ? "     ************     ";
10060 ? " you are losing air ";
10070 ? " and MUST dock with ";
10080 ? " the passing mother ";
10090 ? " ship....GOOD LUCK! ";
10100 R=PEEK(106)-8:RESTORE
10110 FOR P=R*256+512 TO R*256+1024
10120 POKE P,0:NEXT P
10130 FOR P=10 TO 17
10140 READ A,B
10150 POKE R*256+512+P,A
10160 POKE R*256+640+P,B
10170 NEXT P
10180 DATA 7,224,62,124,111,246
10190 DATA 255,255,214,107
10200 DATA 124,62,60,60,4,32
10210 FOR P=0 TO 7
10220 READ A
10230 POKE R*256+768+80+P,A
10240 NEXT P
10250 DATA 24,60,36,60,36,126,90,255
10260 FOR P=0 TO 6
10270 READ A
10280 POKE R*256+896+88+P,A
10290 NEXT P
```

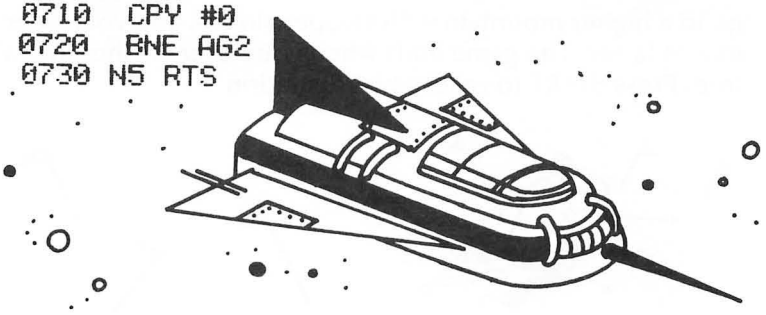
```
10300 ? CHR$(125):COLOR 160:PLOT 0,20:DR
AWTO 39,20:? CHR$(160):POSITION 0,0
10310 POKE 704,8*16
10320 POKE 705,8*16
10330 POKE 706,15*16+10
10340 POKE 707,3*16+4
10350 POKE 53277,3
10360 POKE 559,46
10370 POKE 53248,110
10380 POKE 53249,126
10390 POKE 53250,108
10400 POKE 53256,1
10410 POKE 53257,1
10420 POKE 53258,1
10430 POKE 53259,1
10440 POKE 623,1
10450 POKE 54279,R
10460 DATA 24,60,126,255,255,0,0
10470 POKE 203,110:POKE 204,126
10480 POKE 208,INT(RND(1)*2)+1:POKE 209,
108
10485 K=R*256+768:POKE 206,INT(K/256):PO
KE 205,K-(256*PEEK(206))
10490 RETURN
20000 FOR A=1536 TO 1676:READ B:POKE A,B
:NEXT A
20001 DATA 104,165,208,201,1,240,17,230,
203,230,204,165,204,201,200,208,21,169,1
,133,208,76,38,6,198
20002 DATA 203,198,204,165,203,201,50,20
8,4,169,2,133,208,165,203,141,0,208,165,
204,141,1,208,173,120
20003 DATA 2,201,11,240,10,173,120,2,201
,7,240,8,76,72,6,198,209,76,72,6,230,209
,165,209,141
20004 DATA 2,208,173,132,2,201,0,240,11,
169,0,141,3,208,141,0,210,76,127,6,173,1
0,210,141,195
20005 DATA 2,165,209,141,3,208,169,130,1
41,0,210,160,0,177,205,136,145,205,200,2
00,192,0,208,245,76
20006 DATA 140,6,160,0,177,205,200,145,2
05,136,136,192,0,208,245,96
```

```
20007 RETURN
10  *=$600
20 ;ASSEMBLY ROUTINE USED IN
30 ;SPACE DOCKER WRITTEN BY PAUL BUNN
40 HOR1=$CB
50 HOR2=$CC
60 LF=$D0
70 HOR3=$D1
80  PLA
90  LDA LF
0100  CMP #1
0110  BEQ RIGHT
0120 LEFT INC HOR1
0130  INC HOR2
0140  LDA HOR2
0150  CMP #200
0160  BNE N1
0170  LDA #1
0180  STA LF
0190  JMP N1
0200 RIGHT DEC HOR1
0210  DEC HOR2
0220  LDA HOR1
0230  CMP #50
0240  BNE N1
0250  LDA #2
0260  STA LF
0270 N1 LDA HOR1
0280  STA 53248
0290  LDA HOR2
0300  STA 53249
0310 STICK LDA $278
0320  CMP #11
0330  BEQ L
0340  LDA $278
0350  CMP #7
0360  BEQ R
0370  JMP N2
0380 L DEC HOR3
0390  JMP N2
0400 R INC HOR3
```

FOR ADVANCED PROGRAMMERS

Starting at line 10 (above) is the assembly-language version of the routine that runs from line 2000 to 2007. This is just to give you the opportunity to look over my shoulder and see the process of communicating *directly* with the CPU. Don't type this into your computer, it will only give you all sorts of weird error messages.

```
0410 N2 LDA HOR3
0420  STA 53250
0430  LDA $284
0440  CMP #0
0450  BEQ ON
0460  LDA #0
0470  STA 53251
0480  STA $D200
0490  JMP N4
0500 ON LDA 53770
0510  STA 707
0520  LDA HOR3
0530  STA 53251
0540  LDA #130
0550  STA $D200
0560  LDY #0
0570 AG1 LDA ($CD),Y
0580  DEY
0590  STA ($CD),Y
0600  INY
0610  INY
0620  CPY #0
0630  BNE AG1
0640  JMP N5
0650 N4 LDY #0
0660 AG2 LDA ($CD),Y
0670  INY
0680  STA ($CD),Y
0690  DEY
0700  DEY
0710  CPY #0
0720  BNE AG2
0730 N5 RTS
```



SKI RUN

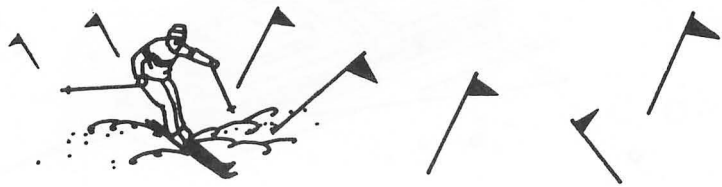
(Joystick)

Notes for typing the program in:

1. Type exactly what is listed.
2. SAVE the program on cassette or disk before you RUN the program.
3. The program is designed for an Atari 400/800 with at least 16K memory, with or without DOS loaded in.
4. If you have a 16K machine, when you RUN it the screen will flash funny colors—this is normal and will stop shortly.
5. When you are about to play Ski Run, switch the computer OFF/ON. LOAD the program in and then RUN. The program will take a few seconds to RUN after the command. Press START for the game to commence.

If you follow the above rules, you will find yourself with a very good, 100% machine code game—quality you would expect from very expensive software.

Use your joystick, plugged into Port 1, to move your skier left or right. To score points run over the blue flags; avoid the trees at all costs. If you are skillful enough to complete a round, you will advance to the next level which means you go to a higher mountain with steeper slopes, and your skier moves faster. The game ends when your skier crashes into a tree. Press START to relieve his frustration.



```
10 REM ** SKI RUN BY PAUL DUNNING **
20 REM
30 REM Make sure you SAVE this program
40 REM before you attempt to RUN it !
45 REM
50 GOSUB 1000
60 GOSUB 2000
70 GOSUB 3000
80 GOSUB 4000
90 X=USR(1663)
1000 FOR A=1536 TO 1646:READ B:POKE A,B:
NEXT A
1001 DATA 112,112,112,70,0,60,7,0,6,6,11
8,217,35,54,54,54,54,54,54,54,54,54,54,5
4,54
1002 DATA 54,54,54,54,54,54,54,54,65,0,6
,0,24,24,24,24,60,60,60,60,60,60,126,126
,126
1003 DATA 126,126,126,255,255,255,255,25
5,255,255,255,126,126,24,24,24,24,24,0,2
55,255,255,255,255,255
1004 DATA 255,255,192,192,192,192,192,19
2,192,192,3,3,3,3,3,3,3,3,0,0,0,0,0,0,0,0
1005 DATA 0,7,31,127,31,7,1,1,1,0,0
1006 RETURN
2000 FOR A=13568 TO 14636:READ B:POKE A,
B:NEXT A
2001 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2002 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2003 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2004 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2005 DATA 0,0,0,101,110,100,0,111,102,0,
114,111,117,110,100,0,0,0,0,0,0,0,0,0,0,0
2006 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2007 DATA 0,0,110,101,120,116,0,114,111,
117,110,100,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
2008 DATA 0,99,111,109,105,110,103,0,0,1
17,112,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0
```

```
2009 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2010 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2011 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2012 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2013 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2014 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2015 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2016 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2017 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2018 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2019 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2020 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2021 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,8,
0,8,0,0,0,0,0,0,0,0
2022 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2023 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2024 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2025 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2026 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2027 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2028 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2029 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
2030 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0
```

```
2031 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0
2032 DATA 0,51,43,41,0,50,53,46,0,0,0,0,0,
0,0,0,0,0,0,0,0,51,35,47,50,37,0
2033 DATA 16,16,16,16,16,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,0,0
2034 DATA 0,0,0,0,0,63,63,63,63,63,63,63,63
3,63,63,63,63,63,63,63,63,63,63,63,63,63,63
2035 DATA 63,63,63,0,0,0,0,0,0,0,0,0,0,0,0
,0,0,0,0,0,0,0,0,0,0,0,0
2036 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0
2037 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0
2038 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0
2039 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0
2040 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,0
2041 DATA 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,0,0,36
2042 DATA 36,36,36,36,36,36,36,36,36,36,36,
36,36,36,36,36,0,0,0,0,0,0,0,0,0,0
2043 DATA 0,0,0,0,0,0,0,0,0,0,0,129,129,12
9,90,90,90,60,60,60
2044 RETURN
3000 FOR A=14848 TO 15475:READ B:POKE A,
B:NEXT A
3001 DATA 169,175,141,1,210,169,0,141,11
,6,169,32,141,12,6,169,14,141,200,2,169,
200,141,196,2
3002 DATA 169,32,133,213,169,120,141,197
,2,162,6,169,0,157,0,29,202,208,248,160,
0,185,0,224,153
3003 DATA 0,56,185,0,225,153,0,57,185,0,
226,153,0,58,185,0,227,153,0,59,136,208,
229,169,32
3004 DATA 133,208,162,16,160,0,169,0,145
,207,136,208,249,230,208,202,208,242,169
,56,141,244,2,160,88
3005 DATA 185,37,6,153,8,56,136,208,247,
169,0,141,48,2,169,6,141,49,2,166,213,17
3,10,210,133
```

```
3006 DATA 205,173,10,210,41,14,9,32,133,
206,169,1,160,0,145,205,160,24,169,2,145
,205,160,48,169
3007 DATA 3,145,205,160,72,169,4,145,205
,202,208,215,162,32,173,10,210,133,205,1
73,10,210,41,14,9
3008 DATA 32,133,206,160,0,177,205,201,0
,208,234,169,73,145,205,202,208,227,162,
0,169,0,157,0,32
3009 DATA 202,208,248,32,131,9,32,17,10,
160,0,140,5,212,32,32,9,152,72,104,168,1
73,120,2,201
3010 DATA 7,240,26,201,11,240,3,76,14,9,
165,212,201,56,240,29,198,212,165,212,14
1,0,208,141,1
3011 DATA 208,76,14,9,165,212,201,192,24
0,10,230,212,165,212,141,0,208,141,1,208
,173,4,208,201,0
3012 DATA 240,3,32,235,9,200,192,8,208,1
82,76,52,9,152,72,160,24,162,0,202,208,2
53,169,0,141
3013 DATA 0,210,136,208,243,104,168,96,1
73,11,6,24,105,24,141,11,6,173,12,6,105,
0,141,12,6
3014 DATA 173,12,6,201,45,240,3,76,209,8
,169,0,169,0,141,11,6,169,27,141,12,6,17
3,35,9
3015 DATA 201,7,240,3,206,35,9,162,0,138
,72,32,32,9,104,170,202,208,246,141,11,6
,169,32,141
3016 DATA 12,6,165,213,24,105,10,133,213
,76,44,8,169,58,141,192,2,169,0,141,193,
2,169,128,141
3017 DATA 0,208,133,212,169,128,141,1,20
8,169,0,141,2,208,141,3,208,141,4,208,14
1,5,208,141,6
3018 DATA 208,141,7,208,169,3,141,29,208
,169,48,141,7,212,169,62,141,47,2,162,0,
169,0,157,0
3019 DATA 52,157,0,53,202,208,245,162,17
,189,0,31,157,128,53,202,208,247,162,17,
189,32,31,157,128
3020 DATA 52,202,208,247,162,96,189,0,30
,157,255,59,202,208,247,96,173,4,208,201
,2,240,16,173,31
```

```
3021 DATA 208,201,6,208,249,169,255,141,
30,208,76,0,8,72,32,17,10,169,1,141,30,2
08,173,10,210
3022 DATA 141,0,210,96,32,101,10,238,4,2
9,173,4,29,201,10,240,1,96,169,0,141,4,2
9,238,3
3023 DATA 29,173,3,29,201,10,240,1,96,16
9,0,141,3,29,238,2,29,173,2,29,201,10,24
0,1,96
3024 DATA 169,0,141,2,29,238,1,29,173,1,
29,201,10,240,1,96,169,0,141,1,29,238,0,
29,173
3025 DATA 0,29,201,10,240,1,96,169,0,141
,0,29,0,162,5,189,255,28,24,105,16,157,3
0,60,202
3026 DATA 208,244,96
3027 RETURN
4000 FOR A=1663 TO 1738:READ B:POKE A,B:
NEXT A
4001 DATA 104,169,0,133,203,169,53,133,2
04,160,0,132,205,169,27,133,206,177,203,
145,205,200,208,249,230,204
4002 DATA 230,206,165,206,201,32,208,239
,169,0,133,203,133,205,169,58,133,204,16
9,8,133,206,177,203,145
4003 DATA 205,200,208,249,230,204,230,20
6,165,204,201,61,208,239,169,0,133,12,16
9,8,133,13,76,0,8
4005 RETURN
```

How to Write Better Programs

By Tim Hartnell, series editor

There are a number of fine programs in this book, and many of the regular computer magazines contain others. But no matter how good the programs from published sources are, you are certain to get more pleasure from running them if they have been partially or completely written by you. Putting your personal stamp on programs, altering them to reflect your wishes and creativity, is an excellent way to improve the programs, and eventually, of course, you'll become a better and more imaginative programmer.

Programs in magazines, and in books like this one, are ideal as starting points for your own developments. You may also find that advertisements for software packages can be fruitful "idea-starters". You only need to read the description of what the commercially available program does, and you will have the first step toward creating your own program. You have to be careful, of course, not to infringe copyright either in the screen displays, in the name of the program, or the names of the "characters" within the program. However, you will probably find that at a certain point in its development the program will take on a life of its own, growing and evolving away from the original scenario, until you eventually have a completely new game concept and implementation.

Whatever you do, be careful not to pass off other people's work as your own. By all means adapt and improve pub-

lished programs, but do not then present them to magazines as if they were originals. I have lost count of the number of times one of my own programs, from one of my books, has been submitted to me for publication.

Always watch out for new ideas as you look through books, game and computer magazines, or wander through video game arcades. It may be worth keeping notes of ideas you come across for games, for character shapes, for sounds, for dramatic endings and so on. Thus you will never be short of ideas, and you will also be able to merge the material together to produce better games which hold the player's attention for longer.

Games tend to fall into one of three categories, and it is worth making sure of the category into which your proposed program will fall *before* you start to program, since the category of game materially alters the programming approach. This is not to say that, as you develop a program, it will not move from one category into another, nor that a particular game might not extend across two categories, but it is nevertheless useful to keep the various groups separate in your mind, just to clarify your thoughts. The three categories are:

1. Board games
2. "Arcade" (that is, highly visual, fast moving, noisy, real time) games
3. Games of chance (such as Roulette and Snap).

In board games, the quality of play is more important than lightning-fast response, while the arcade-type programs must be kept moving at all costs, even if some "intelligence" from your Martian intruders must be sacrificed to achieve this. Games of chance depend more on their ease of play ("user-friendly" inputs), and an approach to true randomness, than do either of the other categories.

You will find that games programs tend to fall into types, which are subdivisions of the three above mentioned categories. Many board games are variants of chess or checkers; many arcade games started off life as Space Invader-type

games; and games of chance started off in the "real world" of dice and cards. Looking at a program description, or a games machine, and trying to categorize the game you see can help trigger new ideas which fit within that particular game's genre.

There is a school of thought within programming—generally called "structured programming"—which believes that discipline at the beginning of the games-writing process is essential. While less interesting than sitting down at the computer right away, a much better program is produced in the end. I once wrote a program called Dome Dweller, a simulation program in which the player is in charge of a "lunar dome" and must decide which products to manufacture and sell in order to buy oxygen and food for the station's inhabitants. (This program was used in my book *The Book of Listings,* written with Jeremy Ruston, and published by the BBC.) Once I had decided the overall scenario, I worked out the screen display, and came up with an idea as follows:

Oxygen supplies are low
There are 96 people living within your dome in year 3
Money credit is $5,693
Annual maintenance charge is $226
Oxygen tanks hold 811 units
Oxygen costs $8 per unit
Each dome dweller needs 5 units a year
Food stocks stand at 2122
Each dweller needs 3 units a year ($6 each, $576 for dome. This will last 7 years at present population.)
You can trade your unique lunar sculptures with the people who live in other domes. You use up 2 units of oxygen making each one, and sell them for $30.

As you can probably guess from this "sample printout", the idea of the program is to decide how many "unique lunar sculptures" you must make and sell in order to buy oxygen and food, and to pay the "annual maintenance" charge. The problem with this particular program is that making each sculpture uses up oxygen, so you must balance your wish to

make money against the need to use the oxygen intelligently.

You may well wish to try writing such a program yourself. You should end up with an enjoyable program, and writing it will do much to help you develop your programming skills. The first thing to do is to make a list of what the program has to do:

Set up the needed variables
Tell the player the "state of the dome"
Ask how much oxygen to be bought
Check if can afford this, if so buy it, if not go back and ask again
Ask how much food to be bought
Check if can afford this, if so buy it, if not go back and ask again
Update oxygen quantity
Update food quantity
Reduce money left total
Ask how many items of sculpture to be made
Check if there is enough oxygen to make this many, if not go back and ask again
Reduce oxygen quantity by amount needed to make the number of sculptures specified, increase money total to reflect value of sculptures made
Increase the population total slightly, add one to the "current year"
Check if there is enough food in stocks to feed whole population
Check if there is enough oxygen for whole population
Check if there is any money
If any of these conditions are negative (e.g. not enough food) send action to an "end of game" routine
If all are positive, loop back to tell the player the state of the dome, and continue to circle

You could probably write a Dome Dweller program using the list above, together with the "sample printout" information. There is, however, a secret I should like to share with

you which unlocks programming problems almost instantly. You can actually write all the vital parts of a program in minutes, so you can see the raw framework of a program like this running long before you fill in the details. And once you have a framework you can work on it for as long as you like, knowing as you do so that—at every moment in program development—you have a working program. You do not have to wait until the end until you can run it to see how you are going. The secret is to hold the entire program within a series of subroutine calls, all held within a perpetual loop. Here's how it could work with this program. The very first lines you enter in your computer are as follows:

```
10 REM DOME DWELLER
20 GOSUB 1000: REM ASSIGN VARIABLES
30 GOSUB 2000: REM PRINT OUT STATE OF DOME
40 GOSUB 3000: REM OXYGEN
50 GOSUB 4000: REM FOOD
60 GOSUB 5000: REM SCULPTURE
70 GOSUB 6000: REM UPDATE POPULATION
80 GOSUB 7000: REM CHECK ON STATE OF DOME
90 IF (all conditions positive, from GOSUB 7000) THEN
   GOTO 30
100 REM End of game . . .
```

As you can see once you have the master loop set up in this way, it is relatively simple to fill in each of the subroutines one by one, testing each as you do so, and elaborating each one so that you end up eventually with a very good program. The only thing you need now is a list of the variables which you will use with the program.

I find the best way to do this is to use explicit names for variables so that when you are programming you do not have to spend time checking, for example, whether AA stands for the population, or the number of units of oxygen used up in making each item of sculpture. To make programs as easy as possible to transfer between different computers you can stick to two letter variable names, or you can take advantage (if your computer allows it) of long names (such as OXYUSE

for the amount of oxygen used) for variables. Then you have no doubts whatsoever as to the meaning of each variable name. To show how this can work, and to illustrate a further advantage of explicit variable names, here are the variables used in Dome Dweller:

FOLK—population of dome
CASH—money in treasury
FOOD—food stocks on hand
FOODCOST—how much each unit of food costs
FOODNEED—how many units of food were consumed per person per year
ARTCOST—how much oxygen was used up making each piece of sculpture
ARTPAY—how many dollars each piece of sculpture was sold for
OXY—oxygen stocks on hand
OXYNEED—how many units of oxygen were consumed per person per year
OXYCOST—how much each unit of oxygen cost to buy
REPAIR—the cost of annual repairs to the dome
YEAR—the year of the dome's life

Using explicit variable names in this way—although they use up more memory than single or double-letter variable names—makes it very simple to follow through a program, working out what each section of the program actually does. Moreover, and this is the further advantage mentioned, it is very easy when writing the program to insert the formula required for calculations. By this I mean that if, for example, you wished to include (as I do in this program) an indication of how much oxygen is needed for each year, you simply multiply the number of people in the dome (FOLK) by the number of oxygen units each person needs each year (OXYNEED). You can then include within the printouts for the state of the dome a line like:

```
PRINT "THERE ARE"; FOLK; "IN THE DOME"
PRINT "IN YEAR"; YEAR
PRINT "EACH PERSON NEEDS"; OXYNEED; "UNITS OF"
```

```
PRINT "OXYGEN EACH YEAR,";
      OXYNEED*FOLK;" NEEDED"
PRINT "FOR THE WHOLE DOME"
```

It also makes it very easy to check on whether purchases are possible. For example, to buy food, you could say:

```
PRINT "HOW MUCH FOOD WILL YOU BUY?"
INPUT A
IF A*FOODCOST ⟩ CASH THEN GOTO (get another A)
```

So the suggestions given here for improving your programs by the use of "structured programming" include the following:

—draw up a sample printout, or mock-up of the final screen display
—draw up a list of what the program has to do each time through a "master control loop"
—change this list to a series of subroutine calls
—use explicit variable names if possible

It is useful if you are designing programs for others to use to ensure that it is quite clear what the player should do when running the program. There is little point, especially when memory is limited, in including a long set of instructions within the program, but you should certainly write such instructions down. In addition, user prompts should be explicit (such as ENTER THE NUMBER OF GOES YOU WANT) and should include warnings of the limits which will be placed on the input (HOW MANY CARDS WILL YOU START WITH: 1, 2 OR 3?, for instance).

You cannot assume that you will be present every time a program is run, so you should do your best to make it as foolproof as possible. If you can, add error-trapping routines to the program to ensure that a mistake in entering a choice earlier on in the program will not cause it to crash or come up with stupid results later on.

If you read through this section of the book several times and try to apply the ideas to your own programming work, you should find your work quality improves significantly, and also that you can spend more time improving and embellishing a program and less in the raw mechanical task of getting the thing running.

GLOSSARY

A

Accumulator—the place within the computer in which arithmetic computations are performed and where the results of these computations are stored.

Algorithm—the series of steps the computer follows to solve a particular problem.

Alphanumeric—this term is usually used in relation to a keyboard, as in "it is an alphanumeric keyboard", which means that the keyboard has letters as well as numbers. It is also used to refer to the "character set" of the computer. The character set comprises the numbers and letters the computer can print on the screen.

ALU (Arithmetic/Logic Unit)—the part of the computer which does arithmetic (such as addition, subtraction) and where decisions are made.

AND—a Boolean logic operation that the computer uses in its decision-making process. It is based on Boolean algebra, a system developed by mathematician George Boole (1815-64). In Boolean algebra the variables of an expression represent a logical operation such as OR and NOR.

ASCII—stands for American Standard Code for Information Exchange, the most widely used encoding system for English language alphanumerics. There are 128 upper and lower case letters, digits and some special characters. ASCII converts the symbols and control instructions into seven-bit binary combinations.

Assembler—a program which converts other programs written in assembly language into machine code (which the computer can understand directly). Assembly language is a low level programming language which uses easily mem-

orized combinations of two or three letters to represent a particular instruction which the assembler then converts so the machine can understand it. Examples of these are ADD(add), and SUB (subtract). A computer programmed in assembly language tends to work more quickly than one programmed in a higher level language such as BASIC.

B

BASIC—an acronym for Beginners All-Purpose Symbolic Instruction Code. It is the most widely used computer language in the microcomputer field. Although it has been criticized by many people, it has the virtue of being very easy to learn. A great number of BASIC statements resemble ordinary English.

Baud—named after Baudot, a pioneer of telegraphic communications. Baud measures the rate of transfer of information and is approximately equal to one bit per second.

BCD—an abbreviation for Binary Coded Decimal.

Benchmark—a test against which certain functions of the computer can be measured. There are a number of so-called "standard Benchmark tests," but generally these only test speed. This is rarely the aspect of a microcomputer that is of most interest to the potential buyer.

Binary—a numbering system that uses only zeros and ones.

Bit—an abbreviation for Binary Digit. This is the smallest unit of information a computer circuit can recognize.

Boolean Algebra—the system of algebra developed by mathematician George Boole which uses algebraic notation to express logical relationships (*see* AND).

Bootstrap—a short program or routine which is read into the computer when it is first turned on. It orients the computer to accept the longer, following program.

Bug—an error in a computer program which stops the program from running properly. Although it is generally used to mean only a fault or an error in a program, the term bug can also be used for a fault in the computer hardware.

Bus—a number of conductors used for transmitting signals such as data instructions, or power in and out of a computer.

Byte—a group of binary digits which make up a computer word. Eight is the most usual number of bits in a byte.

C

CAI—Computer Assisted Instruction.

CAL—Computer Assisted Learning. The term is generally used to describe programs which involve the learner with the learning process.

Chip—the general term for the entire circuit which is etched onto a small piece of silicon. The chip is, of course, at the heart of the microcomputer.

Clock—the timing device within the computer that synchronizes its operations.

COBOL—a high level language derived from the words Common Business Orientated Language. COBOL is designed primarily for filing and record-keeping.

Comparator—a device which compares two things and produces a signal related to the difference between the two.

Compiler—a computer program that converts high level programming language into binary machine code so the computer can handle it.

Complement—a number which is derived from another according to specified rules.

Computer—a device with three main abilities or functions:

1) to accept data
2) to solve problems
3) to supply results

CPU—stands for Central Processing Unit. This is the heart of the computer's intelligence, where data is handled and instructions are carried out.

Cursor—a character which appears on the TV screen when the computer is operating. It shows where the next character will be printed. On a computer there are usually

"cursor control keys" to allow the user to move the cursor around the screen.

D

Data—information in a form which the computer can process.

Debug—the general term for going through a program and correcting any errors in it, that is, chasing down and removing bugs (*see* Bug).

Digital Computer—a computer which operates on information which is in a discrete form.

Disk/Disc—this is a magnetically sensitized plastic disk, a little smaller than a single play record. This is used for storing programs and for obtaining data. Disks are considerably faster to load than a cassette of the same length program. The disk can be searched very quickly while a program is running for additional data.

Display—the visual output of the computer, generally on a TV or monitor screen.

Dot Matrix Printer—a printer which prints either the listing of a program or that which is displayed on the TV screen. Each letter and character is made up of a number of dots. The higher the number of dots per character the finer the resolution of the printer.

Dynamic Memory—a memory unit within the computer which "forgets" its contents when the power is turned off.

E

Editor—this term is generally used for the routine within the computer which allows you to change lines of a program while you are writing it.

EPROM—stands for Erasable Programmable Read-Only Memory. This is like the ROM in the computer, except that it is fairly easy to load material into an EPROM and it doesn't disappear when you turn the power off. EPROMs

must be placed in a strong ultra violet light to erase them.

Error Messages—the information given by a computer where there is a fault in the coding during a part of a program, usually shown by the computer stopping, and printing a word, or a word and numbers, or a combination of numbers only, at the bottom of the screen. This tells you what mistake has been made. Common mistakes include using the letter O instead of zero in a line, or leaving out a pair of brackets, or one of the brackets, in an expression, or failing to define a variable.

F

File—a collection of related items of information organized in a systematic way.

Floppy Disk—a relatively cheap form of magnetic disk used for storing computer information, and so named because it is quite flexible (*see* Disk/Disc).

Flow Chart—a diagram drawn up before writing a program, in which the main operations are enclosed within rectangles or other shapes and connected by lines, with arrows to represent loops, and decisions written at the branches. It makes writing a program much easier because traps such as infinite loops, or non-defined variables can be caught at an early stage. It may not be worth writing a flow chart for very short programs, but generally a flow chart aids in creating programs.

Firmware—there are three kinds of "ware" in computers: software "temporary" programs; hardware like the ROM which contains permanent information; and firmware in which the information is relatively permanent, as in an EPROM (*see* EPROM).

Flip-Flop—a circuit which maintains one electrical condition until changed to the opposite condition by an input signal.

FORTRAN—an acronym for FORmula TRANslation, this is a high-level, problem orientated computer language for scientific and mathematical use.

G

Gate—an electrical circuit which, although it may accept one or more incoming signals, only sends out a single signal.

Graphics—pictorial information as opposed to letters and numbers.

H

Hard Copy—computer output which is in permanent form.

Hardware—the physical parts of the computer (also see software and firmware).

Hexadecimal (Hex)—a numbering system to the base sixteen. The digits zero to nine are used, as well as the letters A, B, C, D, E and F to represent numbers. A equals 10, B equals 11, C equals 12, and so on. Hex is often used by microprocessor users.

Hex Pad—a keyboard designed specifically for entering hexadecimal notation.

High Level Language—a programming language which allows the user to talk to the computer more or less in English. In general, the higher the level of the language (that is, the closer it is to English), the longer it takes for the computer to translate it into a language it can use. Lower level languages are far more difficult for human operators but are generally executed far more quickly.

I

Input—the information fed into the computer via a keyboard, a microphone, a cassette or a disk.

Input/Output (I/O Device)—a device which accepts information or instructions from the outside world, relays it to the computer, and then, after processing, sends the information out in a form suitable for storing, or in a form which could be understood by a human being.

Instruction—data which directs a single step in the processing of information by the computer (also known as a command).

Integrated Circuit—a complete electronic circuit imprinted on a semiconductor surface.

Interface—the boundary between the computer and a peripheral such as a printer.

Interpreter—a program which translates the high level language fed in by the human operator, into a language which the machine can understand.

Inverter—a logic gate that changes the signal being fed in, to the opposite one.

Interactive Routine—part of a program which is repeated over and over again until a specified condition is reached.

J

Jump Instruction—an instruction which tells the computer to go to another part of the program, when the destination of this move depends on the result of a calculation just performed.

K

K—this relates to the size of the memory. Memory is usually measured in 4K blocks. 1K contains 1,024 bytes.

Keyword—the trigger word in a line of programming, usually the first word after the line number. Keywords include STOP, PRINT and GOTO.

L

Language—computer languages are divided into three sections: high level languages, such as BASIC, which are reasonably close to English and fairly easy for humans to use; low level languages, such as Assembler, that use

short phrases which have some connection with English (ADD for add and RET for return, for instance); and machine code which communicates more or less directly with the machine.

LCD—this stands for Liquid Crystal Diode. Some computers such as the TRS-80 Pocket Computer use an LCD display.

LED—this stands for Light Emitting Diode. The bright red numbers which are often used on watch or clock displays are made up of LEDs.

Logic—the mathematical form of a study of relationships between events.

Loop—a sequence of instructions within a program which is performed over and over again until a particular condition is satisfied.

M

Machine Language or Machine Code—an operation code which can be understood and acted upon directly by the computer.

Magnetic Disk—see Disk and Floppy Disk.

Mainframe—computers are generally divided into three groups, and the group a computer falls into depends more or less on its size. The TS-1000 you are using is a microcomputer; medium sized computers are known as minicomputers; and the giant computers that you sometimes see in science fiction movies are mainframe computers. Until 15 years ago mainframe computers were, in practical terms, the only ones available.

Memory—there are two types of memory within a computer. The first is called ROM (read-only memory); this is the memory that comes already programmed on the computer, which tells the computer how to make decisions and how to carry out arithmetic operations. This memory is unaffected when you turn the computer off. The second type is RAM (random access memory). This memory holds the program you type in at the keyboard or send in via a

cassette or disk. In most computers the computer "forgets" what is in RAM when you turn the power off.

Microprocessor—the heart of any computer. It requires peripheral unit interfaces, such as a power supply and input and output devices, to act as a microcomputer.

MODEM—stands for Modulator Demodulator. This is a device which allows two computers to talk to each other over the telephone. The computers usually use a cradle in which a telephone receiver is placed.

Monitor—this has two meanings in computer terms. One meaning is a television-like display. A monitor has no facility for tuning television programs, and usually the picture produced on a monitor is superior to that produced by an ordinary television. The second meaning of a monitor relates to ROM. The monitor of a computer is described as the information it has built in when you buy it. This information allows it to make decisions and carry out arithmetic computations.

Motherboard—a framework to which extra circuits can be added. These extra circuits often give the computer facilities which are not built-in, such as that of producing sound or of controlling a light pen.

MPU—an abbreviation for Microprocessor Unit.

N

Nano-second—a nano-second is one thousand billionth of a second, the unit of speed in which a computer or a memory chip is often rated.

Non-Volatile Memory—memory which is not lost when the computer is turned off. Some of the smaller computers such as the TRS-80 Pocket Computer have non-volatile memory. The batteries hold the program you enter for several hundred hours.

Not—a Boolean logic operation that changes a binary digit into its opposite.

Null String—a string which contains no characters. It is shown in the program as two double quote marks, without anything between them.

Numeric—pertaining to numbers as opposed to letters (that is, alphabetic). Many keyboards are described as being alphanumeric which means both numbers and letters are provided.

O

Octal—a numbering system which uses eight as the base, and the digits 0, 1, 2, 3, 4, 5, 6 and 7. The Octal system is not used very much nowadays in microcomputer fields. The Hexadecimal system is more common (*see* Hexadecimal).

Operating System—the software or firmware generally provided with the machine that allows you to run other programs.

OR—an arithmetic operation that returns a 1, if one or more inputs are 1.

Oracle—a method of sending text messages with a broadcast television signal. A teletext set is required to decode the messages.

Output—information or data fed out by the computer to such devices as a TV-like screen, a printer or a cassette tape. The output usually consists of the information which the computer has produced as a result of running a program.

Overflow—a number too large or too small for the computer to handle.

P

Pad—see Keypad.

Page—often used to refer to the amount of information needed to fill one TV screen, so you can talk about seeing a page of a program, the amount of the listing that will appear on the screen at one time.

PASCAL—a high level language.

Peripheral—anything which is hooked onto a computer, for control by the computer, such as a disk unit, a printer or a voice synthesizer.

Port—a socket through which information can be fed out of or in to a computer.

Prestel—the British telecom name for a system of calling up pages of information from a central computer via the telephone and displaying them on a television screen. A similar commercial version in the United States is known as The Source.

Program—in computer terms program has two meanings. One is the list of instructions that you feed into a computer, and the second is used as a verb; as in "to program a computer."

PROM—stands for Programmable Read Only Memory. This is a device which can be programmed, and once it is then the program is permanent (*see also* EPROM and ROM).

R

Random Access Memory (RAM)—the memory within a computer which can be changed at will by the person using the computer. The contents of RAM are usually lost when a computer is turned off. RAM is the memory device that stores the program that you type in and also stores the results of calculations in progress.

Read-Only Memory (ROM)—in contrast to RAM, information in ROM cannot be changed by the user of the computer, and the information is not lost when the computer is turned off. The data in ROM is put there by the manufacturers and tells the computer how to make decisions and how to carry out arithmetic computations. The size of ROM and RAM is given in the unit K (*see* K).

Recursion—the continuous repetition of a part of the program.

Register—a specific place in the memory where one or more computer words are stored during operations.

Reserved Word—a word that you cannot use for a variable in a program because the computer will read it as something else. An example is the word TO. Because TO has a specific computer meaning, most computers will reject it as a name for a variable. The same goes for words like FOR, GOTO and STOP.

Routine—this word can be used as a synonym for program, or can refer to a specific section within a program (*see also* Subroutine).

S

Second Generation—this has two meanings. The first applies to computers using transistors, as opposed to first generation computers which used valves. Second generation can also mean the second copy of a particular program; subsequent generations are degraded by more and more noise.

Semiconductor—a material that is usually an electrical insulator but under specific conditions can become a conductor.

Serial—information which is stored or sent in a sequence, one bit at a time.

Signal—an electrical pulse which is a conveyor of data.

Silicon Valley—the popular name given to the area in California where many semiconductor manufacturers are located.

SNOBOL—a high level language.

Software—the program which is entered into the computer by a user which tells the computer what to do.

Software Compatible—this refers to two different computers which can accept programs written for the other.

Static Memory—a non-volatile memory device which retains information so long as the power is turned on, but does not require additional boosts of power to keep the memory in place.

Subroutine—part of a program which is often accessed many times during the execution of the main program. A subroutine ends with an instruction to go back to the line after the one which sent it to the subroutine.

T

Teletext—information transmitted in the top section of a broadcast television picture. It requires a special set to decode it to fill the screen with text information. Teletext messages can be transmitted by cable or over phone lines. Examples of this are the Prestel service in Britain and The Source in the United States.

Teletype—a device like a typewriter which can send information and also receive and print it.

Terminal—a unit independent of the central processing unit. It generally consists of a keyboard and a cathode ray display.

Time Sharing—a process by which a number of users may have access to a large computer which switches rapidly from one user to another in sequence, so each user is under the impression that he or she is the sole user of the computer at that time.

Truth Table—a mathematical table which lists all the possible results of a Boolean logic operation, showing the results you get from various combinations of inputs.

U

UHF—Ultra High Frequency (300-3000 megaHertz).

Ultra Violet Erasing—Ultra violet light must be used to erase EPROMs (*see* EPROM).

V

Variable—a letter or combination of letters and symbols which the computer can assign to a value or a word during the run of a program.

VDU—an abbreviation for Visual Display Unit.

Volatile—refers to memory which "forgets" its contents when the power is turned off.

W

Word—a group of characters, or a series of binary digits, which represent a unit of information and occupy a single storage location. The computer processes a word as a single instruction.

Word Processor—a highly intelligent typewriter which allows the typist to manipulate text, to move it around, to justify margins and to shift whole paragraphs if necessary on a screen before outputting the information onto a printer. Word processors usually have memories, so that standard letters and the text of letters, written earlier, can be stored.

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Compiled by Tim Hartnell

The A to Z Book of Computer Games (McIntire, Thomas C., Tab Books, Blue Ridge Summit, Pa.).

This is a fine Tab book to give you program ideas and ready-to-run programs, although some of the games are a disappointment, such as the overly long Othello program which does not even play, but simply records the moves made by two human players. Others, however, such as Fivecard and Hotshot, are well written, and well worth entering into your microcomputer.

BASIC Computer Games (ed. Ahl, David, Creative Computing Press, Morristown, New Jersey).

This is a classic work, the source of more programming ideas than any other computer games book ever published. I had a meal with David Ahl one night in London after a PCW show and discussed the book. He said that he'd been in the personal computer field almost before there were personal computers, and while many of the games in this book do not seem startling now, the fact that people could write and play games for computer interaction at all seemed quite incredible in the late seventies. The Checkers program and Life for Two are just a couple of the treasures you will find in this splendid program and idea source book.

BASIC Computer Programs for the Home (Sternberg, Charles D., Hayden Book Company, Inc., Rochelle Park, New Jersey).

Traditionally, home computers (when first purchased)

have been used for playing games. One reason why they have not been used for more serious applications stems from the lack of a readily available, comprehensive set of home applications programs that were easy to use and understand and that satisfied the practical requirements of the home. This book provides a set of programs to make your computer start earning its keep. The programs provide a good cross-section of practical applications; these have been designed so as not to rely upon the availability of tape or disk-storage devices. The programs cover a wide field, and are divided into a number of sections: home financial programs (including household expenses and income tax recording); car related programs (including fuel use and trip planning); "Kitchen Helpmates" (including diet and meal planning programs); scheduling programs for home use (including a reminder calendar and a couple of programs which I imagine are designed to short circuit arguments about which television programs will be watched); and "List programs for every purpose" (including Christmas cards, music collections and three versions of an address program).

The BASIC Handbook (Lien, David A., Compusoft Publishing, San Diego, California).

This is an encyclopedia of the BASIC language. Now that BASIC is so firmly established throughout the microcomputer world, it is necessary to make its many dialects understandable so that programs can be transported between different computers. When you have found exactly the program you've been looking for, it is very frustrating to be unable to run it on your computer. This book addresses that problem by discussing in detail just about every commonly used BASIC statement, function, operator and command. For the most part, BASIC words mean the same thing to every computer which recognizes them. If a computer does not possess the capabilities of a needed or specified word, there are often ways to accomplish the same function by using another word, or combination of words. Although the handbook requires some

application to transform the information into usable form, it is a very valuable reference work indeed. Every BASIC word you have ever heard of (and many you may not have heard of, such as LE, NE, GOTO-OF, RES and TIME) is probably in the book. It may be of limited use to you in your early days of computing, but it should become an indispensable handbook once you get more involved in the subject.

Beat the Odds, Microcomputer Simulations of Casino Games (Sagan, Hans, Hayden Book Company, Inc., Rochelle Park, New Jersey).

The book explains how to play certain casino games (trente-et-quarante, roulette, chemin-de-fer, craps and blackjack) and gives complete program listings in BASIC with commentaries on systems and optimal strategies. Professor Sagan (Professor of Mathematics at North Carolina State University) says he wrote the book in an attempt to convince people that, in the long run, they could not win—except possibly at blackjack—and to explain some popular systems and their pitfalls, and above all to provide very realistic computer simulations of the games themselves. He has succeeded in his attempt. The listings are possibly longer than other computer versions of the same games, but this is because the Sagan versions strictly duplicate the odds involved in playing the game "in real life", and cover all the eventualities that a real game can produce. The programs are well-structured, and an examination of the listings should give you ideas for improving your own programming.

The Calculator Game Book for Kids of All Ages (Hartman, Arlene, Signet Books, New York).

The book's title says it all, and the names of the games (which include Fibonacci Follies, Stretch to Sixty and Casting Out 9s) suggest the book's contents. There are some worthwhile brain-stretching puzzles, and 15 or so ideas definitely calling for conversion to computer games.

33 Challenging Computer Games for TRS-80/Apple/PET (Chance, David, Tab Books, Blue Ridge Summit, Pa.).

Even if you don't have any of the three computers named in the title, you will still find the book a goldmine of ideas for your own development, and many of them will run, with minimal alteration, on any BASIC-using computer. Particularly commendable programs are Life Support, Scrambled Eggs and Tank Assault.

Communicating with Microcomputers (Witten, Ian H., Academic Press, London).

This is an introduction to the technology of man/computer communications for the non-specialist. By placing particular emphasis on low-cost techniques associated with small systems and personal computers, the reader's attention is focused on the positive nature of the "microprocessor revolution"—how machines can help people—rather than the negative aspects which are often highlighted in the non-technical press. The level of the book is suitable for the layman with some acquaintance with electronics. The final section, on speech communication, provides the most fascinating reading.

Computer Games for Businesses, Schools and Homes (Nahigian, J. Victor and Hodges, William S., Winthrop Publishers Inc., Cambridge, Mass.).

Some of the programs are a little thin for the size and price of the book, but the best ones are well worth adapting to run on your computer. The inclusion of long, clear sample run printouts ensures that you know exactly what the programs will do before you run them. The Tennis and Star Trek programs are especially good.

Games for Home, Travel and Parties (Jensen, Helen, Western Publishing Company Inc., Racine, Wisconsin).

Aimed squarely at children, this book gives some games which are simple to program (these include Snakes, Lift-Off and Fish), and contains a complete chapter on how to play chess.

Home Computers, Questions and Answers, Hardware (Didday, Rich, dilithium Press).

The book has two main purposes. First, it is intended to

give readers a real feeling for what is involved in home computing, so that they can make rational decisions before buying equipment. Second, it is intended to give people who have no specialized knowledge of computing a general background to the subject, and specifically to microcomputers. The book succeeds in imparting enough information to ensure you will have little trouble understanding articles about advanced projects in computer hobby magazines, advertisements for home computing equipment, or other people who do have advanced computer knowledge.

Inside BASIC Games (Mateosian, Richard, Sybex).

This book is a guide, albeit a slightly overwritten one, for anyone who wishes to understand computer games. You will learn how to write interactive programs in BASIC and how the principles of systems development are applied to small computers. The book also looks at how the features of specific small computer systems have been supported in BASIC. The sections of the book include: Arithmetic Games, Guessing Games, Time Games, Date Games, Taxman, and programming in "Free BASIC": a structured BASIC that is translated manually into the actual BASIC instructions to be entered into the computer. Free BASIC is not a language; it is a program description medium (like flow charts) that has no line numbers, and uses symbolic names for subroutines. Additional chapters look at The Match-Up Game, Craps and Alien Life. If you can contend with the verbiage, you will find this book well worthwhile.

An Introduction to Personal and Business Computing (Zaks, Rodnay, Sybex).

I had lunch with Rodnay in London during a PCW show and he told me that he thought current American predictions on the growth of the personal computer field were grossly pessimistic. He pointed out that the predictions current in 1978, when he wrote this book, have been proved so inaccurate that would-be prophets should take warning and assume that whatever they say will be wrong

by a factor of 10 or 100. Despite its age—and computer books do age uncommonly quickly—this book is a good introduction to the field, explaining in clear, snappy English the fundamentals of computer operation. Dr. Zaks also gives suggestions on what to look for when buying a computer.

Microsoft BASIC (Knecht, Ken, dilithium Press, Forest Grove, Oregon).

This book presents a complete introduction to programming in Microsoft BASIC. The concepts presented are illustrated with short, working programs. By starting with the simplest and most commonly used commands, and then progressing on to the more complex BASIC commands, Mr. Knecht shows how the more powerful versions of the language can save valuable programming time and effort.

57 Practical Programs and Games in BASIC (Tracton, Ken, Tab Books, Blue Ridge Summit, Pa.).

There are more serious programs than games (of the Chi-Square Evaluation and Fibonacci Numbers variety) in this book. They are well programmed, and supported by adequate (if brief) documentation, and by flow charts. The Space Wars programs (versions one and two) at the end of the book are particularly good.

Problems for Computer Solution (Rogowski, Stephen J., Creative Computing Press, Morristown, New Jersey).

This outlines over 50 simple (and a few not-so-simple) problems which can be solved by writing a program. There are both teacher and student editions of this book; the teacher edition has a suggested program and sample run printout to solve the difficulty. It is an excellent source for educational ideas.

Stimulating Simulations (Engel, C. W., Hayden Book Company, Inc., New Jersey).

Here, according to the cover, are "12 unique programs in BASIC for the computer hobbyist." Inside you will find some fascinating programs: Forest Fire, Rare Birds and

The Devil's Dungeon are three you are sure to enjoy playing, while Diamond Thief (the computer decides who has committed the crime, then challenges you to discover which of the suspects is guilty) is both well written and tightly programmed.

TAKE TWO! 32 Board Games for 2 Players (Tapson, Frank, A & C Black, London).

This book is aimed at children, but it does give many fascinating ideas that could be transformed into computer games (even if some of them are duplicated elsewhere in the book).

24 Tested, Ready-to-Run Game Programs in BASIC (Tracton, Ken, Tab Books, Blue Ridge Summit, Pa.).

Tab Books are prolific publishers in the microcomputer program field, and their books are deservedly successful. If nothing else, reading a book such as this one will give you ideas for structuring programs neatly, and for writing them to ensure the maximum compatibility between different versions of BASIC. Many of the games, such as Auto Rally and Capture the Alien, are (despite their weak titles) well thought out, carefully constructed programs.

1001 Things to Do with Your Personal Computer (Sawush, Mark, Tab Books, Blue Ridge Summit, Pa.).

I bought this book at a computer fair in Atlanta, and read it (making notes, and turning down page corners) on the flight to London. And I still hadn't finished it on arrival. If you feel you have come to the end of possible applications for your computer, buy this book and discover that you have barely scratched the surface. It tells you about writing music and stories, aiding a mechanic or a carpenter, solving simultaneous equations, astrology, and much, much more.

The World Computer Chess Championship (Hayes, Jean E., and Levy, David N. L., Edinburgh University Press, Edinburgh).

This is a fascinating account of the world's first machine versus machine chess championship, held in 1974, when the dozen or so computer programs taking part were the

only chess programs in existence. The games are analyzed in detail, and the final section of the book outlines a board-numbering system which you could use if you're considering writing your own chess program. The book makes you realize how far the computer world has come in only a few years.

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